Railway Mechanical Engineer

November 1947

«THE WINE RAILWAY APPLIANCE COMPANY · TOLEDO 9, OHIO»

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Electrical Sections of A. A. R. Hold Annual Meetings in Chicago

The two Electrical Sections of the Association of American Railroads held their annual meetings in Chicago, the Engineering Division Section meeting at the Congress Hotel on Tuesday, September 30, and the Mechanical Division Section at the Hotel Sherman on Wednesday, October 1, and Thursday, October 2. A business meeting of the Railway Electric Supply Manufacturers Association was held on October 1.

Although there was no R. E. S. M. A. exhibit, the meetings were well attended and discussion of the reports was vigorous and satisfying

Electrical Section, Engineering Division

The meeting of the Electrical Section, Engineering Division, A. A. R., was opened by its Chairman, K. H. Gordon, assistant electrical engineer, Pennsylvania Railroad, who introduced Armstrong Chinn, Chairman of the Engineering Division, A. A. R. Mr. Chinn greeted the Section, and spoke briefly on the many applications of electrical energy in railroad service. By taking several applications as examples, he showed that practically all railroad functions are dependent upon it, and could not operate without electrical power. He also showed how many railroad services have been enormously improved by means of electrical equipment.

Chairman Gordon followed Mr. Chinn with his own address. He supplemented Mr. Chinn's remarks by saying only a few applications of electrical energy, such as lighting, are evident to those outside the industry, and how many are the ramifications of its uses. Referring to the Section, he said that while the preparation of manual material is perhaps the Section's most important function, the manual does not, by any means, constitute the total of the Section's service to the railroads, since little

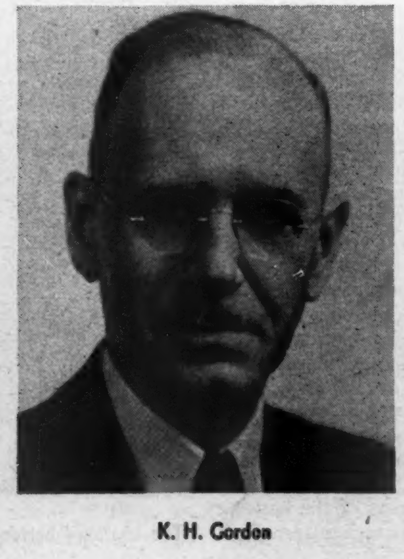
Electrical Section, Engineering Division
Association of American Railroads
Officers

K. H. Gordon, *Chairman,* assistant electrical engineer, Pennsylvania, Philadelphia, Pa.

J. E. Gardner, *Vice Chairman,* electrical engineer, Chicago, Burlington & Quincy, Chicago.

W. S. Lacher, *Secretary,* Electrical Section, Engineering Division, A.A.R., Chicago.

J. E. Gardner



K. H. Gordon

W. S. Lacher

of the work done requires standardization. The reports, he said, are not spectacular or glamorous, but do contain a great wealth of information.

Power Supply

The 1946 report of the committee on power supply describes a lantern battery tester which is used to determine the amount of life remaining in dry batteries used for trainmen's hand lanterns. The tester has been improved and simplified and its cost reduced. A test can be made in 52 seconds and the meter reads directly in "hours life left in battery". Very good results have been obtained with these testers during the past year and they are expected to be used at all locations on the Illinois Central where batteries are issued.

Power for Portable Tools

The subject of portable generating equipment for roadway tools was delegated to C. C. Morgan, superintendent of work equipment and welding, C. M. St. P. & P. He furnished the following information.

"In 1942, Committee 27-Maintenance of Way Work Equipment, of the Construction and Maintenance Section, A.A.R. (A.R.E.A.), prepared a report on an assignment reading, "Portable Electric Power Plant and Electrically Driven Tools," and this was published in A.R.E.A. Bulletin 435, December 1942.

"As is shown in that report there has been a decided trend toward the use of smaller power plants for handling electrically driven tools. This has been discussed recently with two makers of such plants and they both stated that 1500- and 2000-watt plants are selling in much greater numbers than the 3000-watt plant, and they hardly sell any 5-kw. units any more. The Milwaukee Railroad has equipped many of the bridges and building crews with 800-watt lighting plants which provide current also for drill work done in the tool car at the camp. In addition these 800-watt plants are sometimes used on the job when the amount of work to be done does not warrant the operation of the 3000-watt plants normally used.

"The bridge gangs are using the 110-volt single-phase generating plants and most of the small tools in present day use are universal, operating on either a.c. or d.c.

"The advantage of the small capacity units, such as a chain saw is that a man can handle it better and do more accurate work with the small mahine. A modern chain saw is only half as heavy as the old 3-phase 110-volt saws that were used 15 years ago. There is no doubt that the use of electrically driven tools saves money."

Electrical Facilities in Coach Yards

For yard lighting in coach yards, the committee suggests that where there is sufficient room between tracks, lights and circuits can be placed on poles on the platforms.

Power Supply

Standby power supply for passenger cars has become a difficult problem because of greatly increased power requirements. The committee offers suggestions as follows:

"Present yard receptacles for precooling supply are rated at 60 amp., 3 phase, 220 volts, 60 cycles. Receptacles on cars are in general of the same capacity. With the increased load being applied to the newer cars, recognition must be made of the fact that present yard circuits have reached or are beyond the capacity for which they were designed.

"The two manufacturers supplying plugs and receptacles have not as yet standardized on interchangeable equipment in the sizes of larger current carrying capacity and it is recommended that the Electrical Section cooperate in effecting standardization. There will doubtless be required either 75- or 100-amp. plugs and receptacles for precooling requirements, and at present the two manufacturers are at variance in their available equipment. One manufacturer states that the present 60-amp. plugs and receptacles can be converted to handle 75-amp. loads by changing contacts and by replacing the bushing at the rear of the housing to take No. 2 wire instead of No. 4. This manufacturer offers a 100-amp. plug and receptacle in a larger housing which is not interchangeable with the present 60- or proposed 75-amp. equipment.

"Another manufacturer advises that present 60-amp. housing can be adapted to carry either 75-amp. or 100-amp. loads.

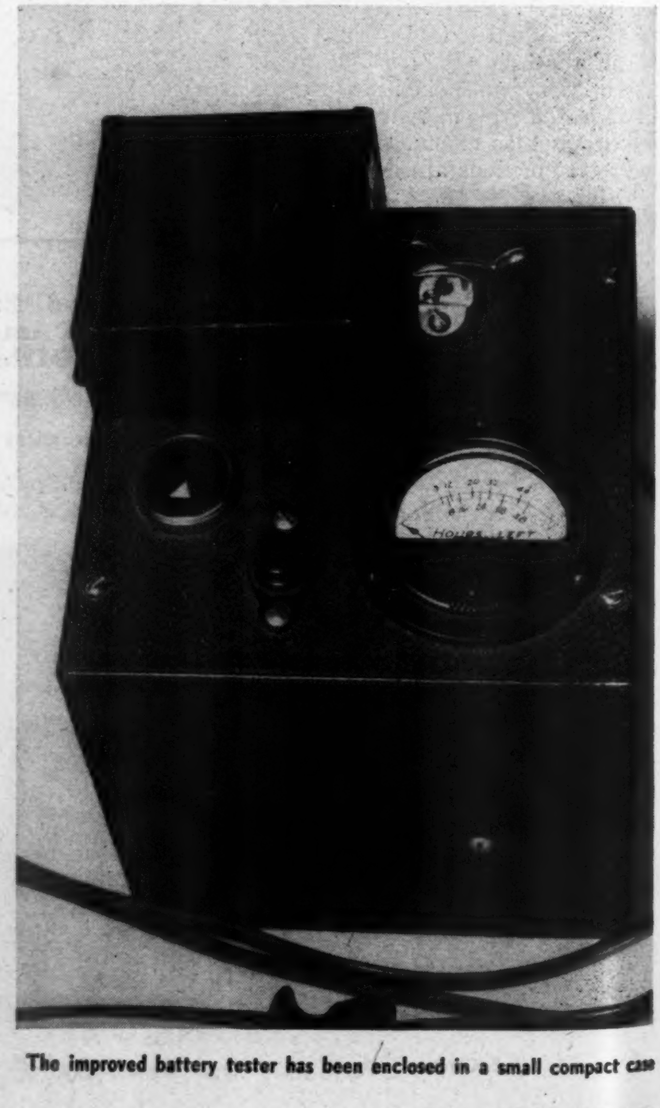
"In view of the desirability of standardization it is recommended that the manufacturers capable of supplying plugs and receptacles for precooling facilities cooperate and mutually agree on an interchangeable plug and receptacle for the 75-amp. size and also for the 100-amp. size. If temperature and other limitations warrant the use of the same dimension plugs and receptacles for the 60-, 75- and 100-amp. rating equipment, the expense involved in remodeling present equipment in yards to increase the capacity will be considerably reduced.

"A joint conference with the equipment manufacturers, and tests of the plugs and receptacles proposed would facilitate standardization.

"Yard receptacles for d.c. charging facilities are interchangeable and may be either 100- or 150-amp. capacity.

"Duplication of yard circuits and receptacles can be avoided where a.c. circuits are installed for precooling facilities by using portable, motor-generator or rectifier sets for d.c. requirements. Some of the railroads are adapting portable welder sets for d.c. charging with good results. Platform spacing and physical conditions such as obstructing water hydrants would be a determining factor in a decision as to use of portable chargers."

The report is signed by C. P. Trueax, (*chairman*), assistant electrical engineer, Illinois Central; S. D. Kutner, (*vice-chairman*), assistant engineer, New York Central; R. Beeuwkes, electrical engineer, Chicago, Milwaukee, St. Paul & Pacific; H. A. Hudson, signal and electrical superintendent, Southern; F. A. Rodgers, engineer, electric lighting and distribution, New York, New Haven & Hartford; G. L. Sealey, assistant engineer,



The improved battery tester has been enclosed in a small compact case

Reading; W. D. Taylor, electrical engineer, central region, Canadian National.

Discussion

The report was presented by C. P. Trueax, assistant electrical engineer, Illinois Central. In response to a question from Armstrong Chinn, chairman, Engineering Division, A. A. R., Mr. Trueax explained that greatly increased connected loads on passenger cars have made it necessary to revise and increase the capacity of standby power facilities in railroad yards and terminals.

S. R. Negley, electrical engineer, Reading Company asked the cost of the battery tester described in the report and Mr. Trueax replied that it is between $30 and $35.00. H. F. Brown, engineer electrical tractions, New York, New Haven & Hartford asked if any progress had been made in charging or rejuvenating dry batteries and Mr. Trueax said there had not.

J. M. Trissal, superintendent communications and electrical engineer, Illinois Central asked why the report stated that the best way to light a coach yard is to use poles between tracks. Mr. Trueax replied that it is best if there is sufficient space between tracks. W. D. Taylor, electrical engineer, Central Region, Canadian National offered the information that there is a yard in Montreal which is equipped with 35-ft. poles, 125-ft. apart on the platforms and that there has been no complaint about the lighting. In this instance no flood-lighting is used, but he added that towers are used in a Toronto, C. N. R. yard and that this affords an opportunity for better general lighting. Mr. Chinn referred to a yard having a single line of poles run down the center of the yard. These poles, he said, carry pipe lines and that in this position corrosion is greatly reduced. Mr. Trissal questioned the use of poles on narrow platforms and Mr. Taylor conceded that the use of poles requires more space, but added that reducing corrosion of pipes is highly advantageous since pipe lines in the ground are a constant source of trouble.

Mr. Trissal said that where cars are cleaned it is almost impossible to avoid serious corrosion of underground conduit. Mr. Taylor said that the C.N.R. has one installation using lead-covered cable in metal conduit which has given good service. Mr. Negley concurred that it is not possible to keep underground conduit out of trouble where cars are washed, but that the Reading is in one case using a pipe tunnel which will insulate the pipes from ground and prevent trouble. The Reading, he said, had had difficulty with lead cable. G. E. Hauss, electrical supervisor, Baltimore & Ohio said the underground conduit is often the source of trouble and called attention to a new standby power installation nearing completion in the Cincinnati Union Terminal.

The question of what is actually being done on standby power installations and whether or not 60-amp. receptacles will be sufficient were raised by Mr. Negley. J. E. Gardner replied that his railroad had used shunting to take care of insufficient receptacle capacity, but that this is considered a temporary expedient. He added that it seems more logical to use portable motor-generators sets or rectifiers operating from the a.c. standby power than to run more d.c. lines. He also said that in some cases platforms were old and not sufficiently strong to carry the chargers. Mr. Trissal wanted to know why so many cars are now being equipped with 25 hp. standby motors. Mr. Gardner replied that many earlier cars did not have sufficient refrigerating capacity and that new lounge cars and diners have greatly increased loads. In the case of 110-volt cars, he said, it was necessary to use genemotors since standby charging facilities were limited to charging 30- and 60-volt batteries. Mr. Brown expressed some doubt about the effectiveness of standby facilities for some applications since at least a minute is required to apply or remove plugs and that on a long train this represented much of the time available for charging or precooling.

Electrolysis

For several years, the Committee on Electrolysis has been investigating the corrosion of steel in concrete buried in the earth. One-inch round steel specimens were placed in concrete cylinders of various sizes, some of which were encased in steel pipe or coated with asphalt. A potential of 25 volts d.c. was applied to the steel rod and after varying periods of time, the effect of this treatment noted. Coating with asphalt, which acts as an insulation to the flow of current, appears to be the only effective means of protection and experiments are now being made to find a practical method of applying asphalt to concrete when it is placed or poured.

The report is signed by A. E. Archambault (*chairman*), assistant engineer, New York Central; H. P. Wright (*vice-chairman*), assistant electrical engineer, Baltimore & Ohio; R. Beeuwkes, electrical engineer, Chicago, Milwaukee, St. Paul & Pacific; Paul Lebenbaum, electrical engineer, Southern Pacific; G. K. Shands, general foreman, Virginian; J. M. Trissal, superintendent of communication and electrical engineer, Illinois Central; S. M. Viele, assistant engineer, office of electrical engineer, Pennsylvania.

Overhead Transmission Line and Catenary Construction

The report is concerned with methods of measuring the height of wires at wire crossings, and it states that for a closely approximate method, the majority of railroads use a small pocket device consisting generally of a sighting tube, on which a small spirit level is mounted at a 45-deg. angle. The device is so arranged that as a sight is taken on a specific point, the user can also see the level bubble simultaneously inside the tube. By sighting on the point and moving backward or forward toward the object being sighted until the bubble is on center, a location can be established where the eye is the same distance horizontally from the point being sighted as the eye is below that point. The height of the wire is then easily computed by adding the distance the user is from the point being sighted, to the height of the eye above rail. The users of such an instrument are enthusiastic about the results obtained. It is contended that accuracy within one or two inches can be attained. Such a device is manufactured by the W. N. Matthews Corporation, of St. Louis, Mo., under the trade name of "Teleheight", and the committee understands that the Dietzgen Company, of New York, also manufactures a similar instrument. Other methods used in varying degrees are as follows:

1. By measuring with a cord or tape thrown over the wires. This method is restricted to heights under 30 ft. and to wires not energized with high-voltage current.
2. By climbing an adjacent pole and determining the elevation of the wire by eye or with a hand level, or by climbing two adjacent poles and sighting from one to the other.
3. By the use of a wooden measuring rod, if the crossing is low.
4. By the use of a 6 ft. sighting stick located at a predetermined distance from the crossing, with the sighting point at a predetermined distance from the sighting stick, and at an established distance above the top of rail.

A questionnaire was sent to 20 railroads, of which 18 replied, with 2 reporting no standardized method. Of the remaining 16, 8 use "Teleheight", 5 use measuring cord or tape, 4 use wooden measuring stick, 2 resort to climbing poles, 1 uses the sighting rod, and 6 use a transit for accurate measurement.

The report is signed by K. H. Gordon, (*chairman*), assistant electrical engineer, Pennsylvania; A. B. Costic, (*vice chairman*), electrical engineer, Delaware, Lackawanna & Western; E. H. Anson, vice president, Gibbs & Hill, Inc.; John Leisenring, electrical superintendent, Illinois Terminal; S. R. Negley, electrical engineer, Reading; H. H. Newman, general foreman, Illinois Central, P. E. Snead, assistant engineer, signal and electrical department, Southern; Sidney Withington, chief electrical engineer, New York, New Haven & Hartford.

Electronics

The morning session was concluded by an innovation in the form of an exposition of electronics by Dr. Gordon Volkenant, associate research director, Minneapolis-Honeywell Regulator Company. Employing a number of quite spectacular demonstrations for illustration, Dr. Volkenant outlined the rapidly expanding field of electronics.

He told how it is being used to control guided missiles and explained the proximity fuse which did so much toward hastening the end of the war. Specifically, he described how it is being used to effect improvements in air conditioning control.

The lighting is adequate at the end of the stalls

Protective Devices and Safety Rules

The report is concerned primarily with the prevention of sparks which may cause fire during the transfer of inflammable liquids or gas or in tanks or tank cars containing such liquids or gas. It deals specifically with revisions of previous reports. First, it offers the following addition: "Wire lines as used here are understood to include also aerial cables."

A previous report states that where wire lines pass overhead there shall be a minimum vertical clearance of 8 ft. at 60 deg. F. between the wires and the tank. This year's report recommends that the temperature be deleted since it causes confusion among non-technical men.

The Interstate Commerce Commission superseded and amended the definitions for compressed gas effective July 18, 1947, and the committee submits for approval, the substitution of the new definition which reads as follows:

(a) A compressed gas for the purposes of these regulations is defined as any material or mixture having in the container either an absolute pressure exceeding 40 lb. per sq. in. at 70 deg. F. or an absolute pressure exceeding 104 lb. per sq. in. at 130 deg. F. or both; or any liquid inflammable material having a Reid* vapor pressure exceeding 40 lb. per sq. in. absolute at 100 deg. F.

(b) Any compressed gas, as defined above shall be classified as an inflammable compressed gas if either (1) a mixture of 13 per cent or less (by volume) with air forms an inflammable mixture** or (2) the inflammability range** with air is greater than 12 per cent regardless of the lower limit.

The report is signed by J. E. Gardner (*chairman*), electrical engineer, Chicago, Burlington & Quincy; J. M. Trissal (*vice-chairman*), superintendent of communication and electrical engineer, Illinois Central; D. M. Burckett, electrical engineer, Boston & Maine; H. F. Finnemore, chief electrical engineer, Canadian National; S. W. Law, signal engineer, Northern Pacific; Paul Lebenbaum, electrical engineer, Southern Pacific; S. M. Viele, assistant engineer, office of electrical engineer, Pennsylvania; R. P. Winton, welding engineer, Norfolk & Western.

* Method of test for vapor pressure of petroleum products, A.S.T.M. designation D 323.

** These limits shall be determined at atmospheric temperature and pressure. The method of sampling and test procedure shall be acceptable to the Bureau of Explosives. The inflammability range is defined as the difference between the minimum and maximum percentage by volume of the material in mixture with air that forms an inflammable mixture.

Application of Motors

The report on application of motors is the work of a joint committee. It was presented at the meetings of both the Electrical Section, Engineering Division and the Electrical Section, Mechanical Division, A. A. R. It is included in this issue with the reports of the latter group.

Illumination

The committee on illumination in its 1947 report presents what is an innovation in enginehouse working conditions in the form of a description of the lighting of the Pennsylvania's steam engine house at East Altoona, Pa.

Fixtures

The lighting fixtures are of the RLM dome or symmetrical angle type as required. They were specially developed for this service. They have the usual white enamel interior finish and are fitted with dust-tight covers gasketed with heavy felt. The cover glass is clear and tempered, and is highly resistant to breakage, either by heat or impact. Should this glass be broken, it shatters into many small, dull-edged pieces, thus minimizing any possible hazard to workmen by reason of broken glass.

The cover is loose-hinged and is retained in position by specially designed adjustable, snap-type clamps which require no tools for their operation. All exposed metal is corrosion resisting. Especial care has been taken to eliminate grooves or pockets in which moisture and dirt could lodge.

The light level over the locomotives is about 25 footcandles

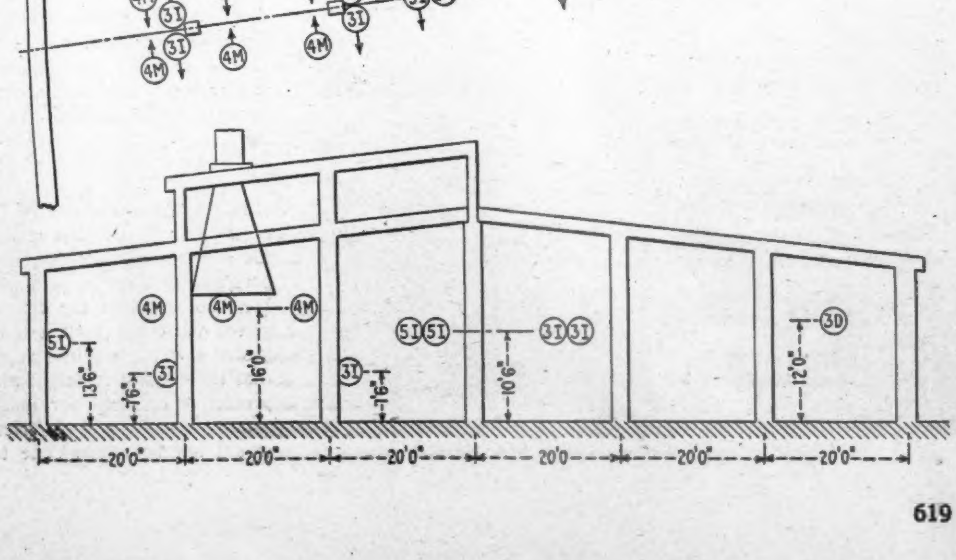
Wiring

Wiring is carried in galvanized conduit and fittings finished after installation with a final coat of mastic compound for protection, in addition to galvanizing. The conduit system is, as far as possible, placed below the smoke line. Nine deion circuit breakers are provided at each stall for flexibility in handling the lights to suit the type of locomotive being handled or the kind and location of work being done. Convenience outlets are on a circuit separate from the lights.

In the low-roof portion of the enginehouse, the fixtures are suspended from the roof. In the high-roof section, the fixtures and conduit are suspended from a bronze messenger cable. The low, angle reflectors opposite the drivers are mounted on columns. The drawing shows the mounting positions of the several lighting fixtures. It was necessary to mount the mercury vapor lights somewhat higher than is desirable so that they would clear the crane boom. Incandescent lamps of 300 and 500-watt capacity and 400-watt mercury vapor lamps are used.

Light Intensity

The light level over substantially the entire side of the locomotive and the top of the boiler is on the order of 25 footcandles, shading off to 10 footcandles at the rear of the tender. These values were determined after the installation had been in service for approximately six weeks. The photographs show night views under the new installation.



Arrangement of lights in a typical stall

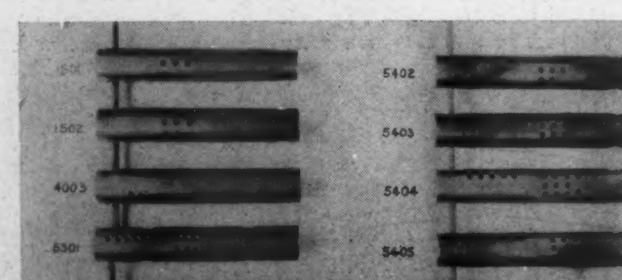
4M—Angle reflector — 400-watt mercury
5I —Angle reflector — 500-watt incandescent
3I —Angle reflector — 300-watt incandescent
3D—RLM dome
The axis of the beam of the angle reflectors is 40 deg. from the vertical.

There is little need for auxiliary lighting

Power Consumption

The connected electrical load at each stall is 6.27 kw. As compared with the power hitherto consumed for this purpose, this amount may be rather startling, but it is thought to be justifiable. When compared with the costs of other terminal facilities, of the equipment to be serviced, of the materials consumed and of the labor involved, the cost of the light becomes relatively insignificant. The time lost by workmen on account of retarded perception due to low light levels, as well as that lost in handling and placing auxiliary lighting apparatus, rapidly mounts to a total which, at existing rates of pay, is surprisingly costly. Adequate light enables the workmen to perform their duties promptly and efficiently, aided by their much higher morale. These are tangible gains which may be evaluated, over a period of time, as has been done in the case of other installations of a similar nature. Less tangible are the benefits to be derived from detection of defects, unnoted under inadequate light, which might cause delay and damage enroute.

The report was signed by E. R. Ale, (*Chairman*), office of electrical engineer, Pennsylvania; L. S. Billau, (*vice-chairman*), electrical engineer, Baltimore & Ohio; J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy; V. R. Hasty electrical engineer, Union Pacific; H. A. Hudson, signal and electrical superintendent, Southern; S. D. Kutner, assistant engineer, New York Central; G. L. Sealey, assistant engineer, Reading; W. D. Taylor, electrical engineer, central region, Canadian National; C. A. Williamson, electrical engineer, Texas & New Orleans.



Typical group of test specimens after cleaning

Discussion

The report was presented by E. R. Ale, office of electrical engineer, Pennsylvania Railroad. J. O. Fraker, electrical engineer, Texas & Pacific asked if the fixtures used in the Pennsylvania's Cast Altoona lighting installation are available for purchase. Mr. Ale replied that the original manufacturer has sold his business to the Appleton Electric Company, and that the Pennsylvania expected to have more of them. In response to a question on pit lines, Mr. Ale said that it was necessary to depend on some pit lighting and the use of portables. He added that the use of lime on the floor, reflected so much light as to make portables almost unnecessary.

Application of Corrosion Resisting Materials to Railroad Electrical Construction

This year's report concludes the data derived from tests which have been made over a period of years on corrosion resisting materials. One set of tests was made in the smoke jack of an enginehouse at Cedar Hill, Conn., another in Hemphill tunel near Welch, W. Va., and a third in a yard at Lambert Point, Va., where the materials tested were subject to salt air. In all cases, samples of various metals and alloys were suspended overhead and were removed, examined, cleaned and weighed at intervals. The materials included various types of aluminum alloys, brass, leaded brass, muntz metal, a wide variety of bronzes, copper, copper nickel alloy, chrome nickel alloy, malleable iron, ingot iron, wrought iron, carbon steel (black), carbon steel (galvanized), copper bearing iron and steel, chrome steel, chrome nickel steel and chrome-nickel steel. Generally it can be said that the bronzes offered the highest resistance to corrosion and that good results were also obtained with chrome-nickel-molybdenum steel, silicon iron and chrome-nickel steel.

The committee's conclusions are as follows:

The Cedar Hill test was an accelerated test in which the corrosive conditions were much worse than the usual conditions on a railroad using steam locomotives. The Hemphill Tunnel test represents about the worst corrosive conditions on a railroad using steam locomotives. The Lambert Point test represents about average corrosive conditions caused by a moderate number of steam locomotives near salt water.

In general, materials which showed relatively good corrosion resistance in the accelerated tests at Cedar Hill also showed relatively good corrosion resistance in the service tests at Hemphill Tunnel and Lambert Point. However, the depth of loss of sample 0403 of 17 ST aluminum at Lambert Point was 5.7 per cent of that of the sample at Cedar Hill, while sample 3201 of 18-8 stainless steel at Lambert Point was only 0.086 per cent of the sample at Cedar Hill. Therefore, it would be impossible to predict accurately the loss of various materials in service from accelerated tests in a smoke jack.

The report is signed by R. P. Winton, (*chairman*) welding engineer, Norfolk & Western; H. F. Brown, (*vice chairman*), engineer, electric traction, New York, New Haven & Hartford; A. E. Archambault, assistant engineer, New York Central; L. B. Curtis, office engineer, c/o electrical engineer, Pennsylvania; C. G. Lovell, assistant electrical engineer, Chicago, Milwaukee, St. Paul & Pacific; S. R. Negley, electrical engineer, Reading; C. R. Wadham, assistant engineer, Illinois Central.

Discussion

In presenting the report, H. F. Brown, engineer electric traction, New Haven, said that stainless steels which were badly pitted in the accelerated tests, stood up very well in other tests. The coppers and bronzes he said were most highly resistant to corrosion. He also said that the committee feels it has in this report completed what has been a long continued piece of work, and suggested that all previous reports might be put together. He added that the committee might also study the value of various kinds of protective coatings for metals. J. M. Trissal, superintendent of communications and electrical engineer, Illinois Central asked if it would not be appropriate to mention that the stranded samples

tested were not under tension since when wires are under tension, gas and moisture does not come in contact with inner strands. Mr. Brown said this was a good suggestion and should be included. H. H. Fabry, supervisor specialty sales, American Steel & Wire Company endorsed the consolidation of this report with those issued previously. Chairman Gordon said this suggestion would be taken up by the committee of direction. He said that it is of great importance that composite wires be under tension and added that when cables are over the track, rather than at one side of the track on which steam locomotives are operated, the core wires are much more subject to corrosion.

Mr. Brown said that tests made by the committee indicate that aluminum is not good for railroad applications and expressed curiosity about an article appearing in the Railway Age which describes an enginehouse having an aluminum roof truss. E. R. Ale, office of electrical engineer, Pennsylvania said his road had tried aluminum headlight cases but had not found them satisfactory. Chairman Gordon said that aluminum insulator caps and other fittings used in overhead wire construction had been protected successfully by a bitumastic coating.

Concerning future work, Mr. Trissal said that a year ago, a Mr. Anderson of the Shell Oil Company suggested that interested companies get together to study cathodic protection, the A. A. R. being represented by the Signal and Electrical Sections. Mr. Febrey suggested that the committee might be interested in recent work done on a new type of arc-welded bond.

Electrical Section, Mechanical Division

The Wednesday, October 1, 1947, meeting of the Electrical Section, Mechanical Division, A. A. R., was called to order by Chairman G. E. Hauss, electrical supervisor, Baltimore & Ohio. Five new members were introduced, and Mr. Hauss called attention to the fact that J. A. Andreucetti had retired as chief electrical engineer, of the Chicago & North Western, but has been retained as secretary of the Electrical Section.

Election of Officers

Chairman Hauss announced the election of the following slate of officers: Chairman: J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy; Vice Chairman (east): L. S. Billau, electrical engineer, Baltimore & Ohio; Vice Chairman (west): F. O. Marshall, chief engineer, Pullman Company; Committee of Direction: H. C. Paige, assistant mechanical engineer, New York, New Haven & Hartford, and L. E. Grant, engineer of tests, Chicago, Milwaukee, St. Paul & Pacific.

Electrical Section, Mechanical Division
Association of American Railroads
Officers

G. E. Hauss, *Chairman*, Electrical Supervisor, Baltimore & Ohio, Cincinnati, Ohio.

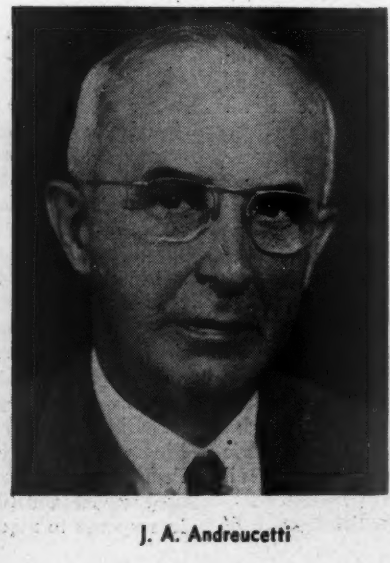
J. E. Gardner, *Vice Chairman (west)*, electrical engineer, Chicago, Burlington & Quincy, Chicago.

L. S. Billau, *Vice Chairman (east)*, electrical engineer, Baltimore & Ohio, Baltimore, Md.

J. A. Andreucetti, *Secretary*, Electrical Section, Mechanical Division, A.A.R.

G. E. Hauss

J. E. Gardner



J. A. Andreucetti

L. S. Billau

Automotive and Electric Rolling Stock

A major part of the report consists of data obtained from 42 railroads concerning their lubrication and engine cooling water practices. Tables compiled from this data show that 14 of the railroads use additives for switcher lubricating oil, 19 use straight mineral oil and 6 use both. In the case of 27 roads operating road freight locomotives, it is 15 additives, 11 straight mineral, and one both. Out of 27 roads using road passenger Diesels, 10 use mineral oil, 13 use additives, 2 both and one uses a detergent.

Practices governing oil changes vary widely. In the case of switchers, the governing factors may be oil analysis, 6 months' service, 3 to 6 months' service, 2,000 to 3,000 hours' service, 12 months' service, viscosity and analysis, etc.

Oil changes on road freight power are based on mileages varying from 20,000 to 100,000, on times from 6 to 12 months and on viscosity or analysis or both. Oil analysis and viscosity are also used in the case of road passenger locomotives and when mileage is the criterion, it varies from 30,000 to 80,000. The color of the oil seems to be considered of more importance for passenger power than for the others.

Crank case drainings are re-refined by 14 of the 42 railroads. On 16, they are reclaimed and on 12, they are used as drained. On 26 roads, crank case drainings are given laboratory tests, 6 employ random tests and 9 make no tests. Eight of the roads consider the reclaimed or re-refined oil as good as new oil, 9 use for switchers and motor cars, 10 use it as make-up oil, and the remainder for steam locomotives, as car and track oil, etc.

It is the consensus of opinion that additives are removed when oil is processed, but in most cases, the reclaimed oil is not fortified with additives when it is reused.

Reasons given to changing lubricating oil filters varv widely. It may be governed by a blotter test, by mileage, or time, or in the case of some, color or dirt content.

The results of the questionnaire on engine cooling water indicate very clearly that treatment is considered highly important.

Nickel Cadmium Batteries

A sub-committee has investigated the potentialities of nickel-cadmium storage batteries for Diesel-engine starting. The report states that while it has been established that this battery is adaptable for this class of service, the operations have as yet been too limited to base conclusions on its economic suitability for this class of service.

New Developments

Recent developments in the Diesel-electric locomotive field listed in the report include a 1,500-hp. Alco-G.E. switcher, the addition of aspirators and superchargers to 660-hp. and 1,000-hp. Baldwin locomotives, respectively, the addition of swing bolster type trucks to make these locomotives suitable for passenger service, and 1,500-hp. Baldwin switcher and road type locomotives. It also mentions 2,000-hp. and 3,000-hp. locomotives which have been produced recently. New G. E. developments referred to include a 70-ton, 600-hp. switcher, the amplidyne-excitation system used on Alco and Fairbanks-Morse road locomotives and the motor-generator type locomotives made for the Great Northern.

Load Indicator

A load indicator to show the overload capacity of a Diesel-electric locomotive under all conditions would be a highly desirable device. The report outlines its requirements, and suggests possible means for its development.

Adhesion at High Speed

Tests which have been made indicate that the coefficient of adhesion is independent of speed but in view of the various types of locomotives involved, the committee states it is not prepared to ask the A. A. R. to finance further tests. It adds:

If slipping is suspected with a multiple-unit Diesel-electric locomotive, the following test is suggested to determine rail adhesion:

Connect one traction motor to absorb the entire output of one engine, while the other power plants maintain desired train speed. Connect a recording voltmeter, ammeter, and speedometer to the motor under investigation to obtain the desired information. There are records of tests where wheel slipping at low speeds was positively identified by such a test.

It is recommended that this study be continued as information becomes available from the experience of various railroads.

Wheel-Slip Protection

Concerning the performance characteristics of wheel-slip protection devices, the report states:

On high speed, alternating-current electric locomotives, with the armatures of two driving axles permanently connected in series, a slip relay is satisfactory. This relay is actuated by the difference in voltage, caused by a speed differential between driving axles on which the motors are connected in series; namely, 1 and 2, 3 and 4, and 5 and 6.

It has been indicated that for a Diesel-electric locomotive, the ordinary voltage-actuated, wheel-slip relay is adequate for protection of motors connected in series at low speed, but is not satisfactory with motors connected in parallel at high speed. To provide protection for the latter condition, it can be said that a wheel-slide detection device, similar to that used on main line cars in connection with braking, has proved satisfactory as an anti-slip device on the two driving axles of a multiple-unit car with traction motors connected in series. This device works on the speed differential between two sets of brushes, each set attached to an axle and rotating inside of a stationary commutator.

It is recommended that this study be continued as other devices become available for trial.

Standard Symbols

The committee has made a study of symbols used by the American Standards Association, the American Institute of Electrical Engineers, and several manufacturers. These vary in detail, and in an attempt to develop uniform practice. The report is concluded with seven pages of proposed standard symbols.

The report is signed by W. S. H. Hamilton (*chairman*), equipment electrical engineer, New York Central; J. Stair, Jr., electrical engineer, Pennsylvania; L. S. Billau, electrical engineer, Baltimore & Ohio; R. I. Fort, assistant research engineer, Illinois Central; E. J. Feasey, chief inspector of Diesel equipment, Canadian National; H. F. Mackey, supervisor of Diesel engines, Atchison, Topeka & Santa Fe; H. C. Taylor, Diesel superintendent, Southern; Marion Sharpe, superintendent automotive equipment, Chicago, Rock Island & Pacific; H. C. Paige, assistant mechanical engineer, New York, New Haven & Hartford; R. W. Murray, general supervisor Diesels, Seaboard Air Line; P. H. Verd, superintendent motive power & equipment; K. B. Rowell, Engineering Department, American Locomotive Company; D. R. Staples, Baldwin Locomotive Works; P. A. McGee, Electro-Motive Division, General Motors Corp.; J. K. Stotz, Electrical Engineering Division, Fairbanks-Morse & Co.; T. F. Perkinson, Transportation Engineering Division, General Electric Company; H. E. Dralle, Manager of Transportation Section, Industry Engineering Dept., Westinghouse Electric Corp.

Discussion

The report was presented by W. S. H. Hamilton, equipment electrical engineer, New York Central, with sections of the report presented by sub-committee chairmen. P. R. Verd, superintendent of motive power and equipment, Elgin, Joliet & Eastern, who presented the section on lubricating oil practices, said the subject of oil reclamation is a controversial one, that the response to a questionnaire indicated the advisability of more standardization and that next year the committee hopes to make recommendations. He added that he wishes to learn if oils having different additives will mix and if waste-type filters remove additives.

L. S. Billau, electrical engineer, Baltimore & Ohio, presented the section on nickel cadmium batteries. Mr. Verd asked if these batteries could be placed in the same space as lead batteries and Mr. Billau said they would fit in the same compartments. M. A. Pinney, assistant electrical engineer, Pennsylvania, added that the Pennsylvania has a 110-volt, 175-amp-hr. battery which has been used on 600- and 1000-hp. switchers which fits existing containers. In response to a question by Mr. Verd on costs, Mr. Pinney said

if the batteries will serve for 10 to 12 years, they will be competitive with lead batteries. The question of arctic-climate operations was raised by K. J. Loftheim, O. C. T., research and engineering division, U. S. Army. Mr. Billau said that laboratory studies had been made. H. Pryor, Electric Storage Battery Company, said this is essentially a matter of operating practice and added that his company has prepared a complete set of instructions for cold weather operation.

Mr. Billau inquired for information concerning the practice of determining proper charging of batteries by measuring the electrolyte level. Mr. Pryor replied that it was good and that a loss of ½-in. per month indicates proper charging, with less indicating undercharging, and more overcharging. In response to further questioning he said that the regulator must he set higher in cold weather than in warm. With reference to the setting of the regulator, W. E. Dunn, Electric Storage Battery Company, said that there is an Exide battery operating on the Milwaukee with Waukesha equipment having thermal control of the charging rate which is operating very satisfactorily.

In response to questions on actual operation, raised by R. W. Tonning, Jr., electrical engineer, Atlantic Coast Line, Mr. Pinney said that the Pennsylvania's nickel-cadmium battery had developed a leaker caused by overfilling and that the battery had been redesigned and replaced in service. The new box, he said, will, on the manufacturer's recommendation, have no ventilation and that the only opening will be a drain hole. A. E. Voight, car lighting and air conditioning engineer, Atchison, Topeka & Santa Fe, then asked how this practice would provide for the disposal of generated gases. W. S. Weff, general electrical foreman, Florida East Coast, asked if consideration had been given to the location of battery boxes on Diesel locomotives. Mr. Billau replied that the wide variety of locomotive designs make recommendations impracticable.

With reference to the standardizations of Diesel traction motors for the purpose of permitting interchangeability, Mr. Hamilton said that two manufacturers have agreed that before they produce another motor for switching locomotives, they will consider the subject of standardization particularly as it applies to physical dimensions.

In presenting the section of the report on load indicators, R. I. Fort, assistant research engineer, Illinois Central, said the subject has been studied intensively, but that nothing tangible has been accomplished. Secretary Andreucetti asked about the manufacturer's attitude on this subject and Mr. Fort said they realize that the development of a loading indicator would improve locomotive utilization.

Concerning the work of sub-committee No. 7 on coefficient of adhesion at high speeds, Mr. Hamilton said in substance: It has been hoped that a speed-adhesion curve might be developed. Experiments indicate that the coefficient of adhesion does not change, and that results obtained are more an indication of the operating characteristics of individual locomotives such as bouncing wheels, spring action, etc. Apparently, also, smaller wheels are more apt to be "slippery" at high speeds than are larger ones. The question has arisen as to whether some device better than the differential relay should not be used to prevent wheel slippage. The present cost of more sensitive devices is high. It is the first or first two axles which give trouble at high speed.

E. J. Feasey, chief inspector of Diesel equipment, Canadian National, presented the section of the report on standard symbols and said it was the shop men who complain most about the use of differing symbols. In most cases, he said, the railroad symbols have been selected by the committee in preference to the manufacturers. It is the intent of the committee, he said, to include wiring on other than Diesel and electric locomotives. S. R. Negley, electrical engineer, Reading Company, offered the opinion that A. S. A. standards should be the guide for all standards. Mr. Feasey answered that the committee has been guided by A. S. A. committees and that the section committees will also deal with manufacturers to produce a set of standard symbols. This action received the endorsement of Secretary Andreucetti.

Mr. Fort presented the section of the report on lamps for Diesel-electric locomotives and explained that it was possible to considerably reduce the number of types in use. A few new types have been suggested, he said, and these are being carefully considered. H. W. Townsend, electrical foreman, Atchison, Topeka & Santa Fe, asked if the questions of illumination had been considered in the selection of lamps. Mr. Fort said that up to the present time it has not but that it will be included in the work of the committee.

Secretary Andreucetti suggested that it would be helpful to study faulty operations of operating relays. Mr. Verbarg said that most road locomotives are less than five years old and that in time costs will be studied more critically. Mr. Verd asked if Diesel locomotives were properly a subject for the Electrical Section and Mr. Andreucetti explained that all work done by the Sections goes to the chief mechanical officers.

Electric Welding

A major portion of the report consists of descriptions of inert gas shielding for arc welding, atomic-hydrogen welding and automatic welding heads.

Inert Gas Shielding

On the subject of inert gas shielding for arc welding, the report states in part:

Basically, inert gas shielded arc welding is quite similar to regular fusion welding in that the metals to be joined are heated to fusion temperature by an electrode. In the inert-arc process, this electrode is bare tungsten, but unlike ordinary welding, it is not deposited in the weld. However, when welding heavy material at high welding currents of 400 to 500 amperes, there is a slight transfer of tungsten from the electrode to the weld pool. Traces only are noticeable when examining an X-ray photograph. Welds can be made by fusing the base metal only, or by additional metal from a filler rod.

The weld is shielded against oxidation by an inert gas, usually argon or helium, which flows through a nozzle in the electrode holder and completely envelops the electrode and molten pool.

A water system with a minimum of 45 and a maximum of 65 lb. pressure is necessary to insure adequate cooling of electrode holder, cable and high frequency pilot coil.

Metals such as magnesium alloys, copper, stainless steel, monel and many others can be welded using helium as a shielding gas.

Probably the most interesting development in inert gas shielded arc welding is its application to aluminum and aluminum alloys on a production basis without the use of any flux whatever.

Atomic-Hydrogen Arc Welding

The atomic-hydrogen process, the report states, differs from other arc welding processes in that the arc is formed between two tungsten electrodes, rather than one electrode and the work. This makes the atomic-hydrogen electrode holder an unusually mobile tool, since it can be moved from place to place without the arc being extinguished.

This arc is completely surrounded by an atmosphere of hydrogen. The hydrogen performs a double function of shielding the molten metal from oxidation and contamination by the air and transferring heat from the arc to the work. This heat transfer is caused by the arc, which supplies heat and breaks down the molecular hydrogen into atomic form. The re-combination of the atomic-hydrogen to molecular liberates heat at the surface of the metal being welded.

Automatic Welding Heads

A fund of information on welding heads is included in the report. A general statement on the subject, taken from the report, is as follows:

By the atomic-hydrogen welding process, welds of approximately the same analysis as the parent metal can be made. The filler rod used in making the deposit should be of the same analysis as the part being welded, except it should contain about one-third more carbon to compensate for the loss of this element during welding. This process deposits a clean smooth weld, free from spatter, pin holes and impurities, such as slag, oxides and nitrides, and is well adapted for welding worn drop forge and forming dies. The heat treating response and machining characteristics of the deposited metal can be made practically identical with those of the parent metal. There are several types of automatic elec-

tric welding heads available for feeding filler metal. These may be placed in three classes; namely, heads for feeding bare or lightly coated electrodes, heads for feeding heavily coated electrodes, and the automatic carbon arc welding heads. The carbon arc heads can be used with or without filler metal.

Qualification Tests

The final section of the report deals with qualification tests for welding operators. The need for a supplementary test arose when it was determined that in some states it is necessary that the welder's qualification tests for certain classes of work must be in accordance with the requirements of the A. S. M. E. Boiler Codes. It, therefore, appeared desirable that the Electrical Section include as an alternate qualification test, one that would be acceptable under state requirements to eliminate the necessity for making two qualification tests. It is the opinion of this committee that the qualification test previously appearing in the Manual is very satisfactory for preliminary testing, but it believes the new method of testing incorporated in this report could well be adopted as the official one for the railroad's permanent record of the individual welder.

The report is signed by L. E. Grant (*Chairman*), engineer of tests, Chicago, Milwaukee, St. Paul & Pacific; A. F. Stiglmeier, general supervisor, boilers and welding, New York Central; Charles Herdy, welding foreman, Illinois Central; M. A. Herzog, chief chemist, St. Louis-San Francisco; J. S. Miller, supervisor welding, New York, New Haven & Hartford; Frank A. Longo, general boiler inspector, Southern Pacific; B. W. Covell, master welder, Northern Pacific; Robert Moran, welding supervisor, Missouri Pacific; John Hengstler, supervisor of welding, Altoona works, Pennsylvania; H. A. Patterson, supervisor of welding equipment, Atchison, Topeka & Santa Fe.

Discussion

L. E. Grant, engineer of tests, Chicago, Milwaukee, St. Paul & Pacific, in presenting the report said that the committee has worked with various other mechanical committees which are also studying welding subjects. He said there has been much objection to rules, particularly rule 23. The section on qualification test for welders, he explained is submitted for inclusion in the manual to replace the material on page ESF 53, 54, 55 and 56.

P. H. Verd, superintendent motive power & equipment, Elgin, Joliet & Eastern, asked if progress has been made in welding cast iron electrically. Mr. Grant replied that two high-nickel content coated electrodes are now being used which do a reasonably good job of welding cast iron. He said, however, he did not think they would be satisfactory for the repair of a broken locomotive cylinder.

Motors and Controls

The major part of the report consists of two studies: One compares the respective merits of synchronous motor-generator sets and rectifiers as sources of shop power, and the other compares portable motor-generator sets with portable rectifiers for charging car batteries.

Shop Power Supply

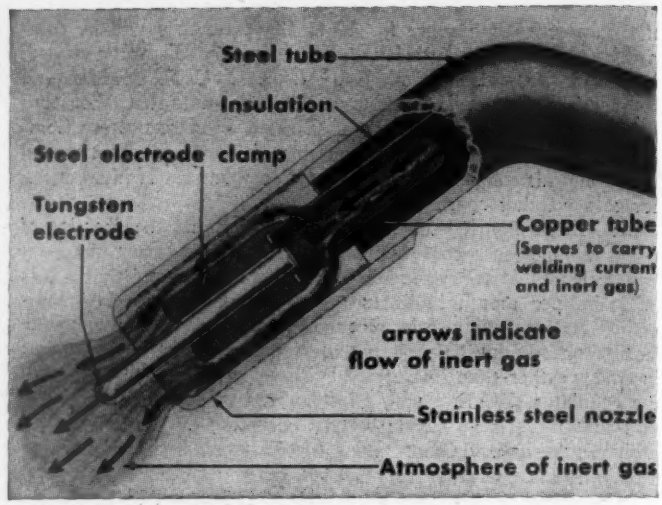
The shop power study is based on an assumed existing shop in which d.c. energy is now supplied by engine-generator sets. The study, however, provides a guide for determining the economics of installing rectifiers as a new shop facility, increased loads, or the replacement of obsolete generating equipment.

Basic Conditions

The following conditions were assumed on the basis that they represent average conditions in a medium size railroad heavy repair shop:

1. Electrical energy at 2,300 volts, 3-phase, 60 cycles, is available at the point of use.

2. Energy is to be converted to 250-volt, d.c. for operation of cranes, turntables, shop motors and some general lighting, representing a portion of the shop electrical requirements. The balance of the equipment is 3-phase, a.c. with most of the lighting load on the a.c. service.



Typical inert-arc electrode holder showing general construction and operating design

3. Space is available in the engine room for installation of either rectifier equipment or motor generator sets.

4. An engineer is on duty 24 hours per day to supervise operation of either type of equipment. The costs of such supervision are not charged to operating costs since it is required under present operation and cannot be eliminated or reduced under either condition of operation.

5. Electricity if purchased from a local power company and billed on a large power rate schedule which contains a sliding scale of rates for demand and energy charges with no discounts. It is assumed that a quantity of a.c. energy is already purchased and that an additional kw. of demand (on a 30-min. basis) will be billed at $1.10 per month and each additional kw.-hr. at $0.0065.

6. The savings to be effected by discontinuing operation of the existing engine generator sets have not been considered in either scheme since the primary purpose of this analysis is to present a comparison of operating costs for motor generators versus rectifiers.

Determination of Load Conditions

A careful analysis should be made of existing requirements to determine peak loads on the 250-volt d.c. system and average loads on each trick weekdays, as well as Sundays or holidays, for selecting size of units to be installed, as well as to determine comparative costs of operation.

A list of all d.c. motors in service and total lighting load will give the total connected load to be provided for as well as furnishing a check of the peak load. At the assumed shop, there is a total of 907½ hp. in d.c. motors, varying from a 3-hp. motor on a small pump, to a 75-hp. motor on a large blast fan. The d.c. lighting load represents only those circuits which have not already been converted to a.c. and totals 75 kw. This represents a total connected load equivalent to 752 kw.

An accurate check of average loads should be made over a period of at least two or three days, including a Sunday or holiday, and at least one normal working day. If a kilowatt-hour meter is available, the engineer can take readings every 15 or 30 minutes on each shift during the check period. If no kilowatt-hour meter is available, readings can be made of ammeter and voltmeter, from which average kilowatt readings can be calculated. It is assumed that a check of voltmeter and ammeter readings at the shop under study are as follows:

	Average Kw.	Peak Kw.
Normal Workdays		
1st shift	180	240
2nd shift	130	200
3rd shift	80	130
Saturdays and Sundays		
1st shift	90	140
2nd shift	100	140
3rd shift	90	120

The loads on the d.c. system listed above are assumed to represent average loads over a 12-month period for simplicity.

If lighting forms an appreciable portion, the winter load will be greater than summer demands and allowance must be made for this variation. A similar allowance should be considered for seasonal variations.

There will be peaks of short duration of greater value than the peak kw. values shown by the meter readings. These peaks can be neglected since either generators or rectifiers have a short time rating considerably above normal so that no harm will result even though the requirements are as high as 125 per cent rated capacity for 2 hours.

Size of Equipment

Either two 300-kw. units or one 300-kw. and one 200-kw. unit could be used.

It was decided to install two 300-kw. units since the importance of shop operations makes it essential that full capacity be available in event of failure of one unit. With full spare capacity, it would not be necessary to restrict shop operations at any time in event of a failure or shutdown of one unit.

The difference in efficiency between 200-kw. and 300-kw. units is very small so that even the lighter loads on third shifts or Sundays can be carried almost as efficiently on the 300-kw. units as on the 200-kw. units. This is particularly true of rectifiers.

Cost of Equipment

The cost of two 300-kw. motor-generator sets with a 40 deg. C. continuous rating, and a capacity of 125 per cent load for 2 hours, is detailed in the report. Including all necessary switchgear, foundation, and installation and electrical work, it would be approximately $42,400.00. The price is based on 80 per cent p.f. synchronous motors. Unity power factor motors could be used which will reduce the overall price approximately 5 per cent, but it is generally considered good practice to use 80 per cent p.f. motors to secure the benefit of power factor correction.

The cost of a comparable pair of sealed-tube, 300 kw. continuously rated rectifiers, capable of carrying 125 per cent load for 2 hours and a 200 per cent load for one minute is given as approximately $42,800.00.

The rectifier tubes require a supply of cooling water of approximately 6 gal. per min. to maintain proper operating temperature. In a majority of cases, raw tap water can be used for cooling, but if there is any question as to the purity of the water, a chemical analysis should be made. If the water is unsuited because of scale forming impurities, a heat exchanger of water to water type, or water to air type, should be used. It is assumed that such a water to water heat exchanger is essential at the proposed location to prevent scaling of water passages.

Cost of Power for Motor-Generator Sets

It is necessary to calculate the total quantity of electrical energy to be purchased, as well as the demands, to arrive at comparative operating costs. Using the assumed average and peak kw. demands listed in an early section of the report, the total energy to be purchased can be calculated with reasonable accuracy as follows:

	Average kw.	kw.-hr.	Overall Eff. at Average kw.	Total kw.-hr.	Total kw.-hr. per day
Normal workdays—					
1st shift	180	1,440	83.5	1,725	
2nd shift	130	1,040	81.0	1,284	
3rd shift	80	640	70.0	914	3,923
Saturdays, Sundays and holidays—					
1st shift	90	720	73.0	986	
2nd shift	100	800	75.0	1,067	
3rd shift	80	640	70.0	914	2,967

On the basis of 114 Saturdays, Sundays and holidays, and 251 normal working days, the total energy input to the motor on the generator set will be:

251 days x 3,923 kw.hr. per day	984,673
114 days x 2,967 kw.-hr. per day	338,238
Total kw.-hr. per year	1,322,911

The maximum demand on the d.c. system as outlined previously is assumed on a 30 minute basis as 240 kw. The overall efficiency of the motor-generator set at this load is approximately 86 per cent so that the increased demand on the purchased energy service will be 279 kw. The assumption is made that a.c. energy is already purchased in considerable quantities and that the additional energy and demand will add to the present billing values. Normally the demand on the d.c. system will not occur in exactly the same period and a diversity factor might be used which would reduce the total. For an estimate of this type, it is well to be conservative and to add present and additional demands numerically.

Cost of Operation and Maintenance of Motor Generator Sets

Fixed charges representing 13 per cent (interest, depreciation and taxes) on a total expenditure of $42,400.00 amount to $5,512.00.

Electrical Energy:		
1,322,911 kw.-hr./year @ $.0065/kw.-hr.	$8,599.00	
279 kw.-hr. demand @ $1.10 x 12 mo.	3,683.00	$12,282.00

The total kw.-hr. will be purchased on the lowest bracket of the rate schedule as outlined in paragraph 5 of the assumed conditions. The demand charge which is paid monthly is likewise billed at a lower bracket on the demand charge schedule.

Supplies—Oil, brushes, etc. amount to $120.00

Maintenance—Labor and material amount to $360.00

The total cost of operation and maintenance per year amounts to $18,274.00.

Electrical Energy Input to Rectifiers

The energy input to the rectifiers is calculated in the same manner as for the generator sets, using assumed average and peak kw. demands, with the efficiencies at average load obtained from efficiency curves, as follows:

	Average kw.	kw.-hr.	Overall Eff. at Average kw.	Total kw.-hr.	Total kw.-hr. per day
Normal workdays—					
1st shift	180	1,440	91.3	1,577	
2nd shift	130	1,040	91.0	1,143	
3rd shift	80	640	90.0	711	3,431
Saturdays, Sundays and Holidays—					
1st shift	90	720	90.4	796	
2nd shift	100	800	90.8	881	
3rd shift	80	640	90.0	711	2,388

On the basis of 114 Saturdays, Sundays and holidays, and 251 normal working days, the total energy input to the rectifier transformer will be:

251 days x 3,431 kw.-hr. per day	861,181
114 days x 2,388 kw.-hr. per day	272,232
Total kw.-hr. per year	1,133,413

The maximum demand on the d.c. system is 240 kw. on a 30 min. basis. At this load, the overall rectifier efficiency is 91.3 per cent or an actual demand on the a.c. system of 263 kw.

Cost of Operation and Maintenance of Rectifiers

Fixed charges representing 13 per cent (interest, depreciation and taxes) on a total expenditure of $42,800.00 amounts to $5,564.00.

Electrical Energy:	
1,133,413 kw.-hr. per year @ $.0065 kw.-hr.	$7,367.00
263 kw. demand @ $1.10 x 12 mo.	3,472.00
Total	10,839.00

As outlined previously, the kw.-hr. and demands are purchased and billing is based on low brackets of the power company rate schedule.

The cost of miscellaneous supplies is $60.00.

Cooling Water:

It is assumed that water available for cooling rectifier tubes has impurities which make it undesirable for direct cooling and a water to water heat exchanger is included. It is assumed that 6 gal. per min. of water is required for cooling which is purchased at a cost of $0.10 per 1,000 gal. Total cost of cooling water is $315.00.

Replacement Tubes:

Rectifier tubes will have a normal life of approximately four years and the six tubes in each rectifier will have to be replaced. Replacement tubes cost approximately $300.00 and an average of 1½ tubes must be replaced each year.

Cost of replacement tubes	$450.00
Maintenance—labor and material	240.00
Total cost per year	690.00

The total cost of operation and maintenance of rectifiers per year is $17,468.00.

Comparative Costs for Generators and Rectifiers

Total cost of two generator sets	$42,400.00
Total cost of two rectifiers	42,800.00
Annual cost of operating generators	18,274.00
Annual cost of operating rectifiers	17,468.00

Summary

The total initial costs of installation for either motor generator sets or rectifiers on the basis outlined above will be about the same. In the case of the motor generator sets, metalclad switchgear units are included for both motor starting and d.c. distribution for comparison with the rectifier units which are completely enclosed. Industrial type motor controllers, open d.c. switchgear panels and unity power factor synchronous motor might be used which will reduce the total installed cost approximately $12,000.00, resulting in a reduction in fixed charges and operating cost.

The cost of the rectifier units can be reduced approximately $4,000 by using oil filled transformers and open distribution panels in lieu of the Askarel filled transformers and metalclad distribution panels. The regulations of the National Electrical Code will require a vault for the oil filled transformer, whereas Askarel filled transformers can be installed in a building without other protection.

Conclusions

The comparison outlined above indicates that sealed tube rectifiers are more economical in operating and maintenance costs than motor generator sets even for loads where the demands in kw. are high, and the consumption in kw.-hr. relatively low. The conditions at the assumed shop were based on a total connected load of 752 kw., a peak of 240 kw., and average loads on an 8-hour shift from 80 to 180 kw. which represents a low consumption in comparison to the demand and connected load. It will be noted that both the rectifier and generator sets have excess capacity and can carry much higher loads than shown. Such increased loads will show a greater saving by the use of the rectifier due to its higher efficiency at all loads in comparison with the motor generator sets.

At the same time the initial installed costs of the motor generator sets can be reduced, as outlined in the summary, which will reduce the fixed charges and require a smaller original expenditure.

In view of these facts, it is impracticable to make definite recommendations as to whether generator sets or rectifier sets should be installed for a particular application. An analysis should be made using the outline above, with consideration given to all associated conditions, to arrive at a specific decision for that application.

Portable Rectifiers v.s. Motor-Generator Sets for Battery Charging

The two general classes of types of storage batteries in common use are the lead type with acid electrolyte, and the nickel-iron type with alkaline electrolyte.

On discharge, the voltage per cell for the lead type is about 2.05 at the start and 1.75 at the finish. Charging starts at about 2.1 volts and finishes at about 2.5 volts.

It is recommended for a lead type storage battery that a certain starting rate of charge be maintained until the cell voltage has reached about 2.5 volts and that a reduced rate or "trickle" charge then be maintained until the voltage again reaches 2.5 volts.

Each nickel-iron cell starts discharging at about 1.45 volts and finishes around 1.1 volts. It starts charging at about 1.55 volts and finishes around 1.8 volts. A constant rate of charge is recommended for the nickel-iron type in contrast to that for the lead type.

Both the motor generator and the copper oxide rectifier type charger meet these requirements satisfactorily, and the operations are all automatic in so far as the charging rate is concerned for lead-type cells. Both are designed to insure complete charge and yet result in the longest possible battery life. However, the efficiencies and power factors at which they meet these requirements are quite different and are considered in a following section.

As far as the load is concerned, there are usually two types encountered with railway car batteries. One is a 32-volt battery which uses either 25 cells of the nickel-iron type or 16 cells of the lead type. The second is a 64-volt battery which uses 32 cells of the lead type or 50 nickel-iron cells. The trend in railway car battery voltage is ever upward, many of the recent cars being equipped with 110-volt batteries.

Both the motor generator and the copper oxide type chargers are designed specifically for these loads, and the operations necessary to switch from one type of a load to another are minimized.

Miscellaneous Requirements of Battery Chargers

Since the battery charger must be moved about to the various cars in the case of railway-car battery with the portable type of charger, it must be as light in weight and economical in space as possible. As far as the weight is concerned, the copper oxide type is much lighter than the motor-generator type, and therefore is much easier to wheel around and more desirable because of this.

Costs

Typical list prices of a portable motor generator battery charger and a copper oxide type of comparable rating for railway car battery use are listed below:

Motor generator	$1,000.00
Copper oxide type	1,500.00

Operating and maintenance costs for the rectifier type of battery charger are comparatively small, the only moving parts being the fan, and its driver. There is some question concerning replacement of the rectifier elements since portable rectifiers for car battery charging service have not been in operation long enough to determine the exact life. Conditions such as high ambient temperature and exposure as well as frequency of operation affect the life, and replacement may eventually be necessary. However, units of this type have been in actual service for over ten years, and manufacturers state that life tests have been in progress on similar units at continuous full load conditions for approximately 20 years without relacement. This represents a decided advantage in favor of the rectifier since maintenance costs will be negligible.

In contrast to this, the motor generator type requires considerable maintenance, peculiar to any type of rotating machinery, such as necessary repairs and replacement of parts.

The efficiency and power factor characteristics for the copper oxide type are fairly constant with varying load, even up to 180 per cent of full load. This is particularly desirable in the event that time is limited and a faster charge,—and hence greater than full-load capacity,—are desired. The efficiency of the motor generator type drops off rapidly over 110-130 per cent of rated load.

The copper oxide type has a very good power factor characteristic, being 90 per cent or greater from about 40 per cent to 180 per cent of rated load, whereas the motor generator type drops off with light loads and is about 85 per cent at full load.

Power Factor Correction

Under the subject of power factor correction, the report includes two charts which indicate that is can be corrected at a lower cost by means of capacitors used in conjunction with induction motors when the motor size is less than 75 to 100 hp., and that costs favor the use of synchronous motors for larger sizes.

The report is signed by the joint committee on Motors and Control whose members are R. H. Herman, (*Chairman*, Joint Committee, and *Chairman* for Electrical Section, Mechanical Division), engineer shops and equipment, Southern; A. B. Miller, electrical inspector, Chicago & North Western; G. O. Moores, assistant engineer, construction and maintenance, Baltimore & Ohio; and A. P. Dunn, (*Chairman*, Electrical Section, Engineering Division), electrical foreman, New York Central; J. A. Cooper, electrical engineer, Wabash; C. P. Trueax, assistant electrical engineer, Illinois Central.

Discussion

The report was presented by R. H. Herman, engineer shops & equipment, Southern Railway. M. A. Pinney, assistant electrical engineer, Pennsylvania asked if a smaller rectifier could not be compared with a larger motor-generator set because of its high peak capacity. Mr. Herman replied that the rectifier will take higher momentary loads, but that both have about the

same maximum rating. W. S. H. Hamilton, equipment electrical engineer, New York Central added that multiple anode rectifiers with pumps will stand instantaneous loads of 5 to 6 times normal rating, but that it is his understanding that sealed-off types cannot take instantaneous peaks much higher than those permissible on a motor-generator set.

It was proposed that a standard welding set would be better for charging batteries than the one described in the report since it would be considerably cheaper, and Mr. Herman explained that the welding set would not be suitable for charging batteries of all voltages. R. H. Russel, efficiency engineer, Great Northern wanted to know if sealed-off rectifiers might be used for charging batteries and Mr. Herman replied they are not practical in sizes below 100-kw. Mr. Hamilton asked about selenium type chargers and Mr. Herman said they have given a good account of themselves and should be considered.

Locomotive Electrical Equipment

The first section of the report which deals with focusing and alignment of headlight beams is summarized in the following paragraphs:

The customary practice where locomotives are serviced is to select a straight section of track from 800 to 1,200 ft. in length, and by adjustments of the focusing device, and by moving or shimming the headlight case, the light beam is focused and aimed. Obviously, this work has to be done at night, and the track space in use must be unoccupied by other locomotives.

Focus and Alignment with Instruments: An instrument has been developed, the use of which permits this work to be done by day or night, with a greatly decreased occupied track distance.

The device consists of a cast aluminum cylinder about 15½ in. in diameter by 9 in. long, with both ends closed. One end is perforated with two rows of small holes located on the horizontal and vertical centerlines. The inside of opposite end is marked with two rows of small white circles in the same relative position. (Fig. 1.)

Fig. 1—Focusing and aligning device

Fig. 2—Application of focusing and aligning device to headlight case

The cylinder is arranged for mounting on the front door ring circle of the headlight case, with the perforated end toward the headlight reflector. (Fig. 2.)

With the headlight burning, the lamp is moved by means of the focusing device until the light shining through the holes in the disc produces uniform images on the white circles. When such condition obtains, it indicates the lamp filament is at the focal point of the reflector. The light images are viewed through a suitable opening in the side of the cylinder.

For alignment, an aligning tube is accurately mounted on top of the cylinder. This tube contains two vertical sights and a mirror mounted at an angle of 45 deg. for viewing a target through the sights. A spirit level is mounted on the side of the tube for leveling the headlight case, aligning it in the vertical plane. (Figs. 1 and 2.)

For horizontal alignment, a target in the form of a vertical rod is placed in the center of a straight track from 100 to 200 ft. in front of the locomotive. The operator then views the target in the 45-deg. mirror, and moves the headlight case until the target lines up accurately with the two vertical sights in the tube. (Fig. 3.)

Prefocused Headlight Lamps

Prefocused headlight lamps are available, and have been used with success by several railroads. These lamps dispense with adjustable focusing devices, and afford a definite and accurate focus.

An alignment device, shown in Fig. 4, was developed primarily for use with headlights using prefocused lamps. It contains the alignment tube with suitable means of attachment to the headlight, and dispenses with the apparatus required for testing the focus of the lamp. The alignment procedure is similar to that described above.

Electric Trainline for Air Brake Control

The report offers alternate arrangements for selection as means for connecting electric air brake trainlines between the rear of a tender and the first car or the rear of the tender and a second locomotive. These are as follows:

Arrangement No. 1, shown in Fig. 5, utilizes a standard receptacle on rear of tender, and a train line cable with standard and similar plugs at each end.

Arrangement No. 2, shown in Fig. 6, utilizes a junction box with the train line cable permanently attached thereto, and a standard plug at outer end of cable for connection to cars.

Figure 7 shows a typical arrangement and the general location of the receptacle on the head end of locomotive for double-heading.

Arrangement No. 1 will probably be found more suitable for connecting to a second locomotive (double-heading), in that

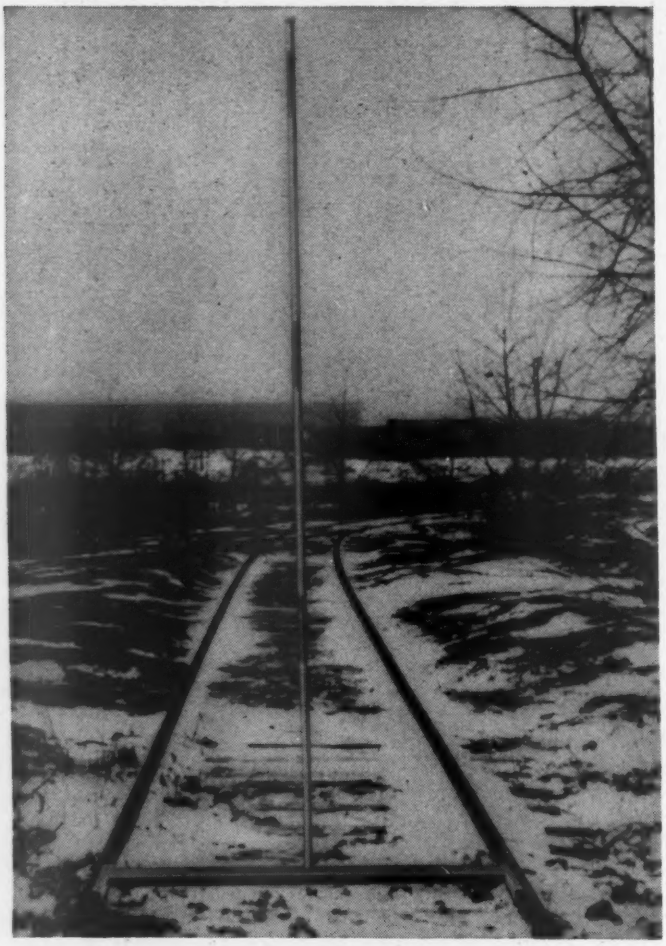


Fig. 3—Track target

a longer train line cable probably will be required between two locomotives. The dummy receptacle, shown in Arrangement No. 2, may likewise be used with Arrangement No. 1, if desired.

Receptacles at the various points indicated shall be as shown in Section "A"—(ES-A-20-1945). The junction box, indicated in Arrangement No. 2 (Fig. 2), shall be as shown in Fig. 8. The dummy receptacle shall consist of an exterior housing of a standard receptacle without the contact unit. The jumper cable shall be as described in Section "A"—(ES-A-18-1945). Color code, wire designation and terminal connections shall be as described in Section "A"—(ES-A-18-1945). Jumper cable lengths where shown herein are only approximate. Due to the variety of locomotive and tender constructions, the required lengths will have to be determined to suit the several types of construction.

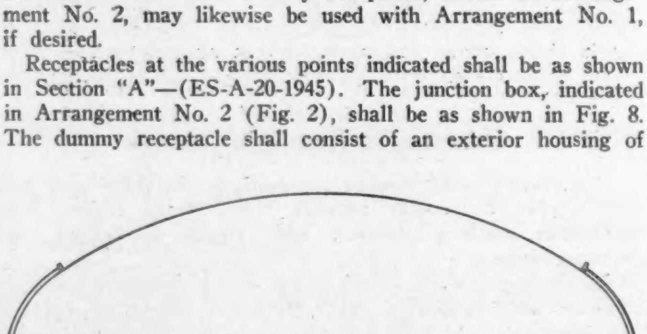


Fig. 5—Application of electro-pneumatic air brake connector to rear of tender—Alternate arrangement No. 1, with receptacle attached to tender

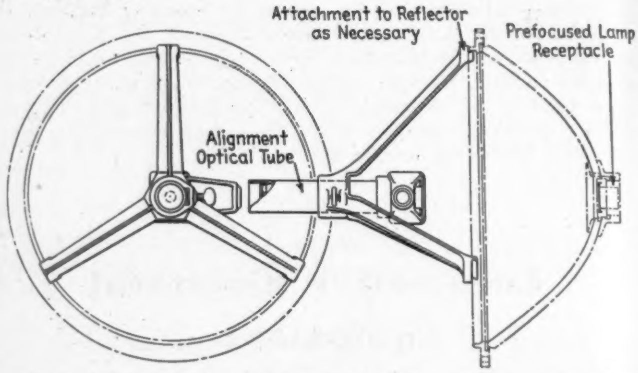


Fig. 4—Aligning device for use with headlights using prefocused lamps

Elimination of Shock to Headlights

For reducing shock and vibration to headlight cases, it is proposed to use rubber in shear with the weight of the headlight case evenly distributed on the shock mounts and the suspension points on the case proper to be mounted as close as possible to the center of gravity, to minimize all uneven vibrational frequencies, as illustrated in Fig. 9.

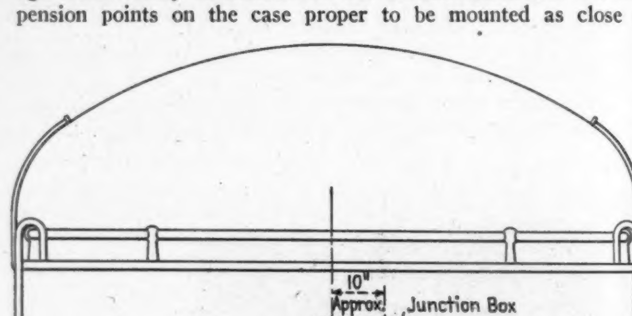


Fig. 6—Application of air brake connector to rear of tender—Alternate arrangement No. 2, with trainline cable attached permanently in junction box

For eliminating shock and vibration from headlight sockets, it is proposed to use rubber in shear, set at a predetermined vibrational frequency, as illustrated by Fig. 10.

Sealed Beam Headlights

The sealed-beam system of headlighting similar to that used on present-day automobiles is being tried out on a strictly experimental basis by some of the eastern railroads on steam locomotives.

This lamp is approximately 7 in. in diameter, and is rated at 200 watts at 30 volts. The rated life is 500 hours. It develops approximately 200,000 beam candle-power with a beam spread of approximately 12 deg. horizontally, and 8 deg. vertically. The lamp is also available in 32-volt rating.

The original plan called for operating two such units in the standard 14-in. headlight housing to produce approximately 400,000 total maximum beam candle-power. (The average beam candle-power obtained from the standard 250-watt, 32-volt locomotive headlight lamp, with a 14-in. glass reflector is 145,000.) However, there appear to exist two schools of thought regarding the use of this new unit, i. e.,—the first is to use the two units together to replace the present 250-watt, 32-volt, 14-in. reflector combination, and the other is to use the sealed-beam unit as a reserve light source in case of lamp burnout in the present headlight system.

Road tests are being conducted on an adapter mounting for two lamps to be used in the present headlight case, and on a single lamp housing to be used on the above-mentioned emergency or spare basis. Results to date on both systems are encouraging.

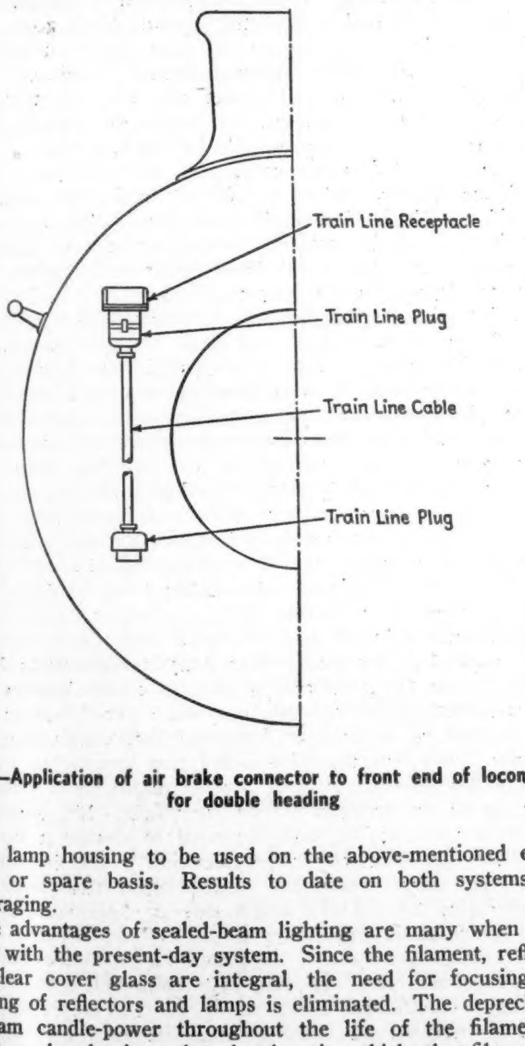


Fig. 7—Application of air brake connector to front end of locomotive for double heading

The advantages of sealed-beam lighting are many when compared with the present-day system. Since the filament, reflector and clear cover glass are integral, the need for focusing and cleaning of reflectors and lamps is eliminated. The depreciation in beam candle-power throughout the life of the filament is greatly reduced, since the chamber in which the filament is operated is much larger than in the case of the present 250-watt, P-25 bulb lamp. Since the sealed-beam unit is made of heat resisting glass, it is not subject to failure due to water cracks, etc., such as encountered occasionally with the P-25 bulb lamp when used in headlight cases with leaky gaskets. Also, loose lamp bases resulting from vibration or strain are eliminated.

The use of the 200-watt, 30-volt, sealed-beam unit offers great possibilities, especially from the standpoint of standardization. Two units operated in multiple will provide better road illumination for steam road locomotives. One unit will be sufficient for swtiching locomotive service.

For Diesel-electric use, a road engine would operate two of the 30-volt units in series on a circuit equipped with a voltage regulator or resistance to provide the 60 volts across the two units. A substitute resistor and switch can be provided in this service to replace either of the units in case of filament burnout in either unit. Where 32 volts is available on Diesel-electric road or switching locomotives, the two units would be operated in multiple.

Diesel-electric switching locomotives would be equipped with one unit operated in series with the proper resistor to deliver 30 volts at the lamp unit terminals.

As in the case of all such ideas, there remains additional work to be carried out in the way of providing better mounting devices to cushion the lamp against vibration and also to maintain alignment of the units. Satisfactory progress is being made on both items. If the present road tests prove the idea desirable, production of any large scale must await the provision of suitable manufacturing equipment for both the lamp and the mounting devices.

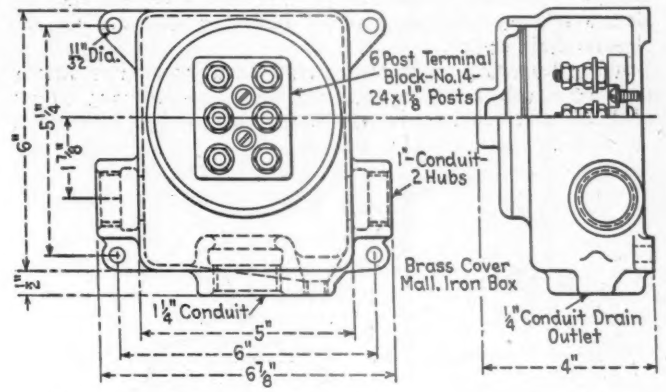


Fig. 8—Junction box

Power from Steam Locomotives for 64-Volt Electro-Pneumatic Air Brakes

The assignment for Sub-Committee No. 5 was to study and report on available apparatus for supplying power from steam locomotives to trains equipped with electro-neumatic air brakes requiring 64 volts for their operation.

Two alternates are given, without preference as follows:

1. Motor-generator set, 500 watts, 32 volts d. c. to 64 volts d. c., single frame, two bearing totally enclosed. Use of this motor-generator set requires that the turbo-generator furnishing electrical power for the locomotive be of sufficient capacity to handle the load imposed by this set, including its conversion losses. Efficiency of the motor-generator set is estimated at 50 per cent.

2. Turbo-generator, 500-watts (minimum), 64 volts, d. c. of conventional design. This generator is considered as supplementing the usual 32-volt generator on the locomotive, but is electrically and physically separate therefrom.

A. C. Turbo-Generators

Sub-Committee No. 6 was given the assignment of reporting on the possibilities of a. c. turbo-generators and auxiliary equipment for supplying power for radio, headlights and train control. The committee's conclusions are as follows:

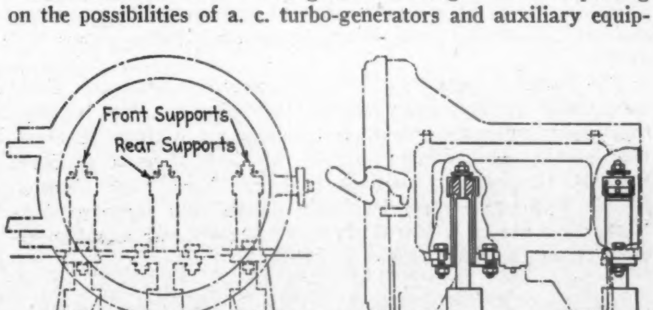


Fig. 9—Rubber shock absorbing units applied in shear on center line of headlight case

The a. c. turbo-generator, if proposed for a single and complete electrical power supply on locomotives, including electro-pneumatic brakes, involving a rating of the order of 2,500 watts, at this time is considered impractical, principally because of the prohibitive size, weight and cost of the auxiliary rectifying

apparatus required for essential d. c. loads, especially that for the electro-pneumatic brakes.

A single and complete electrical power supply on locomotives, excluding electro-pneumatic brakes, involving a rating of the order of 1,500 watts, is considered a borderline case of practicability; subject to the design problems involved, and the size, weight and cost of auxiliary rectifying apparatus for cab signals—train control.

A supplementary, or second generator, on locomotives strictly for loads which require no rectifying apparatus, involving ratings of 1,000 watts or less, is considered practical but with added

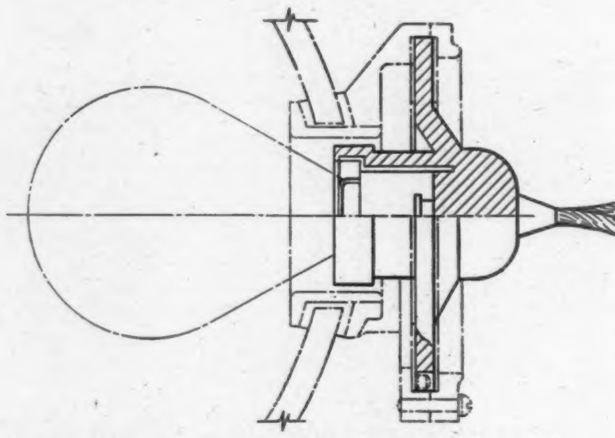


Fig. 10—Socket assembly mounted on rubber in shear—prefocused lamp

objectionable features of space requirements on modern locomotives, and the approximate doubling of turbo-generator maintenance costs.

Inductor Type Generator Preferred

The preferred type of a. c. generator, if used, is the inductor type.

The a. c. generator must not generate frequencies, either fundamental or harmonic, in the range of frequencies used for cab signal or train control systems, unless the generator wiring is electrically and inductively separate from the cab signal—train control wiring.

Certain electrical loads on a locomotive have been designed for direct-current. The cost of changing such apparatus to operate on a. c. of any frequency is prohibitive. The principal electrical loads in question are for cab signal-train control systems (32 volts) and electro-pneumatic brake system (64 volts).

The report is signed by A. D. Whamond (*Chairman*), Foreman, Office of Electrical Engineer, Pennsylvania; W. C. Kelley, supervisor automatic train stop equipment, Illinois Central; Roy Liston, mechanical inspector, Atchison, Topeka & Santa Fe; W. G. Switzer, assistant engineer, New York Central; R. G. Thompson, supervisor cab signals and lighting, New York, New Haven & Hartford; A. C. Zagotta, cab signal supervisor, Chicago, Rock Island & Pacific.

Discussion

The report was presented by A. D. Whamond, foreman, office of electrical engineer, Pennsylvania. The section on trainline for air brake control was presented by W. G. Switzer, assistant engineer, New York Central. H. C. Paige, assistant mechanical egnineer, New York, New Haven & Hartford, asked why no dimensions are shown for lateral displacement of the location of the receptacle on the front end of a locomotive. Mr. Switzer replied that varying construction of locomotives makes it necessary to put the receptacle in different places. Some applications, he said, may require an extra long cable. He added that no reference is made in the report to Diesel locomotives and that it is assumed that this will be handled by the committee on Automotive and Electric Rolling Stock.

Assignment No. 3 on eliminating vibration and shock from headlight cases and sockets was presented by A. C. Zagotta, cab signal supervisor, Rock Island & Pacific. L. J. Verbarg, air conditioning engineering, Missouri Pacific, reported that experiments made on his road, both with rubber in shear and compression, show that rubber in shear is much more effective in extending lamp life.

The section of the report on sealed-beam headlights was presented by Mr. Switzer, who said that filament life as much as 11 months has been obtained with sealed-beam lamps. Secretary J. A. Andreucetti raised the question of pick-up distance and Mr. Switzer said he expected it would be as good with two sealed-beam lamps as with one 250-watt lamp in a 14-in. glass reflector. M. A. Pinney, assistant electrical engineer, Pennsylvania, called attention to the fact that the report states one sealed-beam unit is sufficient for switching service. This he said infers that it is not enough for road service. He added that the Pennsylvania has made tests with one lamp, and obtained the required pickup at 1,000 ft., while the requirements are 800 ft. W. S. H. Hamilton, equipment electrical engineer, New York Central, stated that laboratory tests had been made which show that two sealed-beam lamps will produce 400,000 beam candlepower while single 250-watt, 32-volt lamps give about 365,000 beam candlepower. The beams from two lamps, he said, lie on each other, and lamp filaments are placed at right angles to each other to dispose of the filament image. One 250-watt headlight, he said, will give a 1,300- to 1,400-foot pickup. Upon further questioning by Mr. Andreucetti, Mr. Hamilton said that tests made over a number of years and recent ones on Diesel locomotives bear out these values. This statement was substantiated by Mr. Pinney. He added that an 18-in. silvered copper reflector with a 250-watt lamp will do better, but the silver plating depreciates rapidly and when a locomotive was equipped with a single sealed-beam headlight and an old 18-in. reflector, the engine crew used the sealed-beam lamp out of preference.

Mr. Hamilton called attention to a sentence in the report which states that the sealed beam lamp is available in 30- and 32-volt ratings. It is difficult, he said, to obtain 32 volts at the headlight with 34 at the cab, and since two lamps in series will be used on Diesels, he suggested that standardization on 30 volts seems desirable. He added that two lights are particularly desirable in that they provide means for a locomotive going on to the terminal if one lamp fails. Mr. Andreucetti said it also avoids the delay required to change a headlight lamp. Mr. Hamilton also called attention to the fact that the sealed-beam lamps retain their output longer than lamps with smaller bulbs because the larger interior distributes the materials which cause blackening.

The subject of available apparatus for operation of steam locomotives in trains equipped with electro-pneumatic brakes requiring 64 volts was presented by L. S. Verbarg, air conditioning engineer, Missouri Pacific. He said that for this purpose it is most desirable to have two turbo-generator sets since there are frequently grounds on the locomotive circuits caused by foam meters, etc., and brake circuits should be free of grounds.

With reference to the section of the report which deals with a. c. turbo-generators and auxiliary equipment, Mr. Hamilton took exception to the dimensions of rectifiers shown in the report. He said he had taken this matter up with the manufacturers of selenium rectifiers who said that oil cooling was neither necessary nor desirable. They added that it is possible to have air-cooled rectifiers which would be impervious to cinders and dirt. A 400-cycle rectifier, one manufacturer states, could be built for air brake service which would cost about $85 and weigh only 22 lb., as compared with $600 and 767 lb. for an oil-cooled unit. For intermittent inductive train control an appropriate rectifier would weigh 18 lb. and cost $54, including transformers and rectifier. This would compare with 176 lb. and $200 for the oil-cooled unit. Rectifiers, Mr. Hamilton said, have the big advantage that they isolate the circuits served, and he suggested that they be studied further.

F. A. Kiessling, division electrical foreman, Illinois Central, told how a ground on a headlight caused a false-clear indication

of a cab signal causing a locomotive to go through an interlock in train control territory. The engineman, he said, was taken out of service, and it was later discovered that the difficulty was caused by grease on the headlight generator.

Car Electrical Equipment

Under the heading of new developments, the report describes an endless "V" belt-gear box drive for axle generators of 10-30 kw. capacity.

The drive consists of the following: Two three-groove pulleys with common hub mounted on the axle. A gear box with three-groove pulley on each side, suspended from the truck end sill by means of two hanger brackets and links. Drive from axle to gear box is by means of six two-inch endless "V" belts and thence to the generator by means of bevel gears and the conventional type of splined shaft with flexible joints. Belt tension is maintained by means of an elliptic spring bolted to the end sill hanger bracket and exerting pressure on the axle side of the gear box. All brackets, hangers and gear case are malleable iron castings. Hangers and suspension pins are mounted in rubber and it is claimed that lubrication will not be required.

Total weight of the axle pulley assembly is 285 lb. and the total weight on the truck end sill will not exceed 800 lb.

The endless 2-in. wide "V" belts will be used in the initial application and also in subsequent applications which may be made coincident with wheel turnings, etc., however, when it is necessary to apply belts between wheel turnings, a "V" belt with connector will be used to avoid the necessity of dropping the wheels. Pulley ratio is 17 in. to 14 in. as designed and pulley centers are 2 ft. 6 in.

The arrangement requires a new type of truck end sill and a new type of brake beam. These features have been approved by the truck and brake systems manufacturers, but will probably involve some additional cost. This drive cannot be applied to present conventional truck frames.

Advantages claimed by the manufacturer are reduced weight and bulk on the axle. Weight on the truck end sill is centrally located. Cost will possibly be less than other types of drives of equal capacity. There are no drives of this type in service at the present time; however, the manufacturers expect to have two test units in railway service by the end of the year.

Fluorescent Lamps

Another development described is the use of type K cold cathode fluorescent lamps on 650-volt d.c. power. Special circuits have been designed for their application and typical circuits for these lamps, using ballast lamps and ballasting resistance are shown in Fig. 1.

The New York Central has made changes in its circuit for operating 15 in., 14-watt, T-12 fluorescent lamps on 60 volts d.c., which consist essentially of the addition of a choke coil, change in condenser design, and the addition of a short circuiting strip to the positive lamp holder. With this circuit, standard thermal starters can be used.

These changes have resulted in improved starting of the lamps on low battery voltage. The circuit permits the lamps to be operated from either direct current or alternating current, which may be of some advantage in designing car power plants using Diesel-driven alternators to normally supply the lighting, but utilizing a 64-volt battery for emergencies in the event of normal power supply failure or other periods when the Diesel-alternator must be shut down. This improved circuit is shown in Fig. 4.

The use of Slimline fluorescent lamps in railroad cars is discussed. It is the opinion of the committee that slimline lamps will be used in decorative applications where the size of the lamp is an essential item, or in general lighting equipment which depends on accurate control of the light.

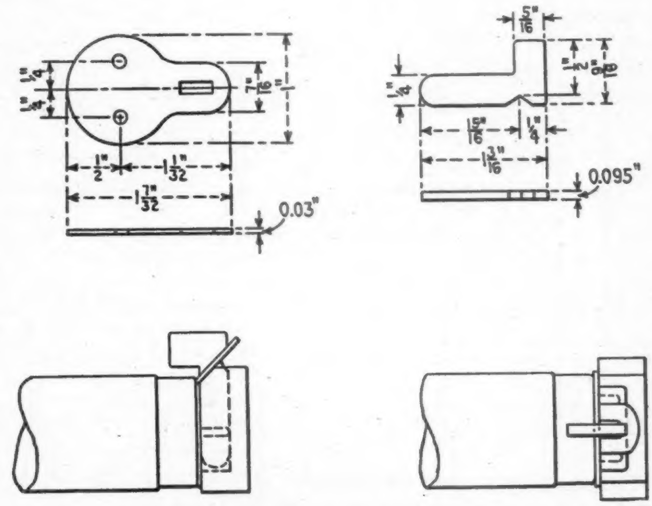


Fig. 2—Fluorescent lamp lock

Some railroads experienced trouble with fluorescent lamps turning in holders (where the holders are of the type in which the lamp contact pins are first inserted in line through an entering slot and then rotated through 90 deg. to lock the lamp in its operating position) due to vibration and dropping out of its holders. An inexpensive and easily applied solution to this trouble was found in the use of the Laduby tube lock. This lock, shown in Fig. 2, consists of a fibre disc with a slotted tab and a fibre locking piece. The disc has two holes which fit over the lamp pins. The disc is placed over the lamp pins and the lamp inserted in its holders, and rotated so that the slotted tab is in line with the lamp holder slot through which the pins originally entered the holder. The fibre locking piece is then inserted through the slotted hole in the tab into the slot in the holder which keeps the lamp from rotating and dropping out. The notch in the locking piece engages the tab and prevents it from dropping out.

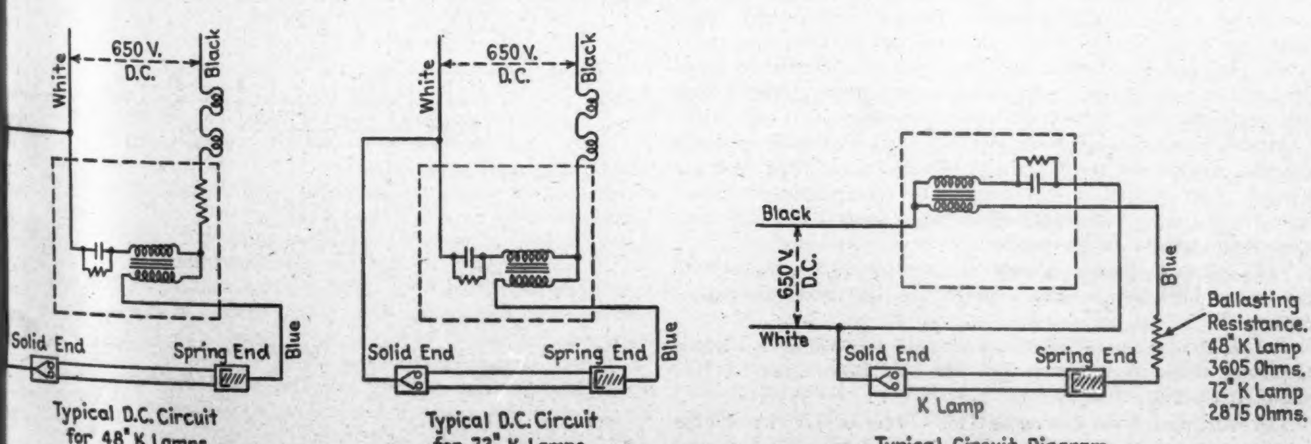


Fig. 1—Diagrams for 650-volt d.c. lamp circuits using ballast lamps and ballasting resistance

Diesel Power Plants

In July, 1946, a subcommittee witnessed tests of Westinghouse Diesel engine-driven alternating current generator as applied to C. M. St. P. & P. coach 4049.

The unit and control equipment were installed in one end of this car in a room provided for the purpose.

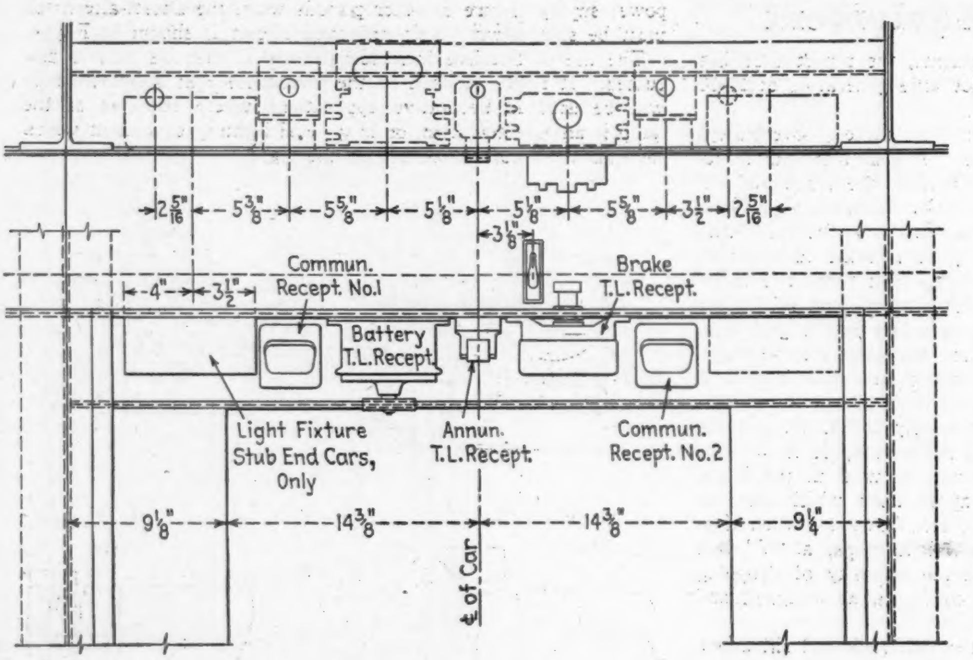


Fig. 3—Arrangement of train-line receptacles on passenger cars

The unit had a maximum capacity of 23 kw. and furnished 220-volt, 60-cycle, 3-phase, power for the following:

Two 5-hp. compressor motors

One 1½-hp. air circulating fan

One ½-hp. condenser pump motor.

One ⅓-hp. single-phase, water circulating pump

One 1-hp. radiator cooling fan

Charging of the 176 amp.-hr. engine starting battery was through a three-phase rectifier unit. Power required for this purpose was estimated at 1 hp.

The main generator was 3-phase, 220-volt, 60-cycle, and field excitation was obtained by means of one field winding excited from the battery and another field winding excited from the output of the generator through a three-phase rectifier unit. Fuel consumption was two gal. per hr. at full load. Frequency regulation was very good and the maximum frequency variation was plus or minus one half cycle.

Voltage regulation was 224 volts at full load to 226 volts at no load. Engine speed was 1,800 r.p.m.

To provide load for engine generator unit when air cooling was not required the car was equipped with 5.25 kw. of electrical floor heat and 4.5 kw. of electrical overhead heat. Air for Diesel engine combustion and generator cooling were taken from car body. Noise levels as taken with DB meter were fairly high but no attempt had been made to effectively sound deaden the unit or car body. The manufacturers thought that this problem could be solved without trouble.

At the conclusion of tests conducted on this car, while in revenue service, by the C. M. St. P. & P. and Westinghouse Electric Corporation, it was decided to remove the equipment from the car for modifications which were deemed desirable from experience gained under actual service conditions.

The Texas & Pacific is applying a General Motors unit to its coach 1300 which was expected to be in service about August 1.

The Illinois Central intends to install two General Electric Company units on a dining car, but this installation has not yet been started.

The exhibition train known as "The Train of Tomorrow" has four cars equipped with General Motor's 25-kw., 220-volt, and 115-volt, 60-cycle, 3-phase Diesel engine-driven generating units and in addition, the dining car on this train has a 40-kw., 220-volt, 3-phase, 60-cycle, unit to serve facilities in the all electric kitchen. These units provide all power required on the cars.

Nickel-Cadmium Batteries

The trade name "Nicad" has now been changed to "Alcad." At the present time, no definite information is available on 32- and 64-volt Alcad batteries for air conditioning service.

The Pennsylvania has two Alcad batteries in service on 110-volt cars, and by next year the Committee expects to be able to present some interesting data on this installation. To date the performance of the batteries on the Pennsylvania cars has been satisfactory.

Trainline Receptacles

Figure 3, page ES-A-21-1945 of the Section manual of recommended practice now shows recommended location of electro-pneumatic brake receptacle, and Fig. 3, page ES-A-25-1940, shows location of battery train line receptacle on ends of passenger cars. Since the adoption of the above locations, there

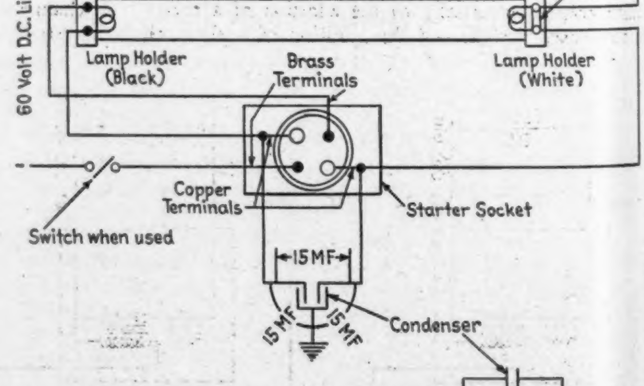


Fig. 4—Wiring arrangement for 64-volt d.c. fluorescent lighting circuits

have come into general use, communication train line receptacles and porter's call bell receptacles. To provide a standard location for the many receptacles now in use and get them in the limited space available, it has been necessary to revise the dimensions shown on the above pages and the Committee offers the accompanying Fig. 3 for adoption as recommended practice to supersede the two "Fig. 3's" referred to above.

The report is signed by L. J. Verbarg (*chairman*), air conditioning engineering, Missouri Pacific; S. B. Pennell (*Vice Chairman*), New York Central; L. C. Bowes, electrical engineer, Chicago, Rock Island & Pacific; J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy; E. S. M. Macnab, car lighting engineer, Canadian Pacific; G. W. Wall, electrical foreman, Delaware, Lackawanna & Western; J. D. Younger, equipment electrical engineer, Illinois Central; M. A. Pinney, assistant electrical engineer, Pennsylvania; H. W. Wreford, train lighting engineer, Canadian National; J. A. Bucy, electrical supervisor, Baltimore & Ohio; R. W. Tonning, electrical engineer, Atlantic Coast Line.

Discussion

The report was presented by L. J. Verbarg, air conditioning engineer, Missouri Pacific. G. W. Wall, foreman electrician, Delaware, Lackawanna & Western, asked if center supports were needed in cars to support slimline lamps or the 48-in. lamps, and wanted to know if any of these lamps had fallen out of their sockets in service. J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy, said that all installations with which he is familiar have enclosing fixtures which would prevent falling. M. A. Pinney, assistant electrical engineer, Pennsylvania, stated that his road has experienced no breakage of 48-in. lamps, that some did turn in their sockets and come out, but were held in the fixture, and that this had been corrected by the use of socket locks. Mr. Hamilton told of a fixture used on the New York Central in which the lamp is not turned into the socket, but is pushed in against a spring. The N.Y.C. unit is an individual fixture and Mr. Pinney asked if the spring loaded socket could be used in continuous fixtures. Mr. Hamilton replied that this would require staggering of the lamps since the sockets are a little too long for avoiding dark spots between lamps.

R. H. Russel, efficiency engineer, Great Northern suggested that a study of fuses be included in future committee assignments. He stated that they are rated at 70 deg. and in railroad service must operate at very different temperatures. He would like, he said, to know more about aging. R. W. Tonning, electrical engineer, Atlantic Coast Line called attention to differences between N.E.A. codes and A.A.R. standards. S. B. Pennel, engineer, New York Central, suggested that a study of circuit breakers also be included.

Car Air Conditioning Equipment

In 1946, the Committee reported on improvements being made to basic units for air conditioning, a particular feature to be the arrangement of parts to facilitate servicing. The 1947 report states that numerous installations have been made subsequent thereto and preliminary reports indicate satisfactory results are being obtained. A number of installations using a rotary inverter for supplying 220-volt, 60-cycle current have been placed in service, and thus far the performance has been exceptional. Additional applications are pending on equipment yet to be built.

The committee in its previous report covered quite adequately the air conditioning equipment applied to a Milwaukee coach which had a Diesel-powered unit for its source of electrical power. After exhaustive tests, this air conditioning equipment was removed. It proved a valuable experiment and resulted in much useful data being obtained as to the layout and types of apparatus as well as performance requirements. Other installations of a similar type, manufactured by Frigidaire, have been placed in service by several roads and are also in use on the cars in the "Train of Tomorrow." These have not been in service long enough to draw conclusions, but they will be under observation by the committee, and it is hoped valuable information on this type of equipment will be available for next year's report.

In the report on this assignment last year, the means used for providing adequate kitchen ventilation was described. During the past year, many new units of dining car equipment have been placed in service. The trend with these cars has been to use an air intake fan of sufficient capacity to supply air through ducts to the kitchen and pantry which is subsequently exhausted by suction fans usually located over the range and the steam table and the range blower units. There are usually additional exhaust fans in the pantry to balance out the system.

The primary object of this ventilation is to remove the excess heat and vapors prevalent in a dining car kitchen and provide as comfortable crew working conditions as possible.

Last year, as a supplement to the written report, there was read to those assembled at the annual meeting, a description of a pressurized system of ventilation developed on the Southern Pacific. The object was to eliminate the necessity for exhaust fans, but, at the same time, provide a method for exhausting air by maintaining a positive pressure of 1 inch of water inside the car. The installations in service are reported as being entirely satisfactory and that exhaust fans have been eliminated. This system can be arranged whereby the air exhausts through the toilets, regulator, and electric lockers, or any other location where exhaust air is desirable. It is reported that this system of air changing will be applied on all new cars now on order for the Southern Pacific. On some Rock Island cars now in service, using the pressurized system, damper control is used for adjusting both fresh and recirculated air, the adjustments being made from the vestibule of the car ceiling. This arrangement is subject to tampering, and it is felt that an inside adjustment only on the recirculated grille, which can be locked, once the pressure is obtained, is by far the most desirable. A common set of filters for both fresh and recirculated air is desirable. These, however, should be readily accessible for proper maintenance.

In the committee's report for 1940 on this assignment a very comprehensive description was given of the Multi-Vent system of ventilation and air distribution. Subsequent to the report numerous installations have been made and entirely satisfactory performance has been reported. Exceptionally uniform temperatures have been obtained throughout the car, along with practically draftless air distribution. Likewise, it is reported that on cars using this system, dirt and odor problems are minimized. The Multi-Vent action traps the dirt (and odors), saving the upholstery and draperies, etc., at the same time depositing it on the upper surface of the perforated distributing plate. This is usually fine dirt, sometimes containing oil and water droplets, which is easily wiped off the surface when the hinged distribution plate is lowered. With the latest trend in sleeping cars to more extensive use of individual room accommodations, multivent designs have been developed for individual room control. These units are called Multi-Vent Room-Master panels. A turn of the control knob operates the Multi-Vent valve through the entire range from minimum to maximum settings. This permits the passenger the selection of the air delivery that provides him the greatest comfort. Regardless of the valve adjustment, the air distribution is draftless.

Filters

In its 1946 report, the committee covered quite thoroughly the three types of electro-static precipitation being developed for use in connection with air cleaning on railroad air-conditioned passenger cars. At that time, the difficulties encountered with such applications were noted, and the manufacturers had indicated that they were cognizant of these and were proceeding with their designs in an effort to overcome them. The committee has been exceptionally active on this subject, but to date has been unable to obtain any additional information about these units due to the reluctance of the manufacturers to divulge any important information relative to their product. It has been reported that some of these units are being applied to new passenger cars now in the process of building. There appears to the committee that a definite lull appears in the progress toward the development of an electro-static filter to meet the exacting requirements of railroad service.

As a supplement to its 1946 report, there was read into the minutes of the annual meeting, a description of the Annis filter, using water in connection with its filter arrangement. Subse-

quent to submitting this, an installation has been made on a Pullman car which is operating regularly between Chicago and the west coast on the Santa Fe. On this installation, it has been advisable to install heating coils where the fresh air is pulled in to obviate the danger of freezing the spray and to temper the air that is taken in. A humidistat has also been installed in order to control the humidity within proper limits.

The equipment has made several trips with fairly good results. It has not been in service sufficiently long to draw conclusive results, but much valuable data has already been obtained. By using a humidistat, it has been possible to keep the relative humidity within or close to the comfort zone. There has been thus far no need to clean the filters, although the car operates through the "Dust Bowl" section of the country.

Temperature and Humidity Control

The committee suggests some changes of definitions and recommendations made in its 1946 report. One of these concerns cycling modulation and reads as follows:

Cycling modulation utilizes two unique elements, a double bulb thermostat and finned tube radiation which has an inner feed pipe to insure uniform temperature of the heating surfaces. One bulb of the thermostat is responsive to room temperature and the other bulb has an electric heater winding, which when energized causes the mercury to rise in the column, close the steam admission valve and then open the circuit to the heater winding on the thermostat bulb. In this manner, a cycling effect is produced to supply impulses of steam to the heating system.

Under the heading "Simplification of Controls," it was recommended that the temperature control be consolidated in a single three-position switch, i.e., "Day," "Off," "Night." These three positions should be "Off" in the center, "Day" to the right, and "Night" to the left. As an additional recommendation, the committee suggests that on sleeping cars the "Night" setting be slightly lower than the "Day" setting, since the passenger is protected with blankets during slumber periods in sleeping cars.

Under the heading, "Heating Systems," the committee suggests that the last paragraph commencing "Under these conditions, . . ." should be omitted, and the following two paragraphs added to clarify the information on this subject:

In one type of radiant heating, the inside sheets and window glass are heated by means of a column of warm air rising from the side wall radiator. In another system, the sheets and window glass are heated electrically.

With radiant heating, the temperature of the air in the car can be appreciably lower than with the conventional heating system.

Refrigeration

Under the heading of "Food Preservation," the committee recommends that the following be added to its 1946 report:

If desired, the fan can be controlled by the door light switch so that the fan only operates when the door is closed. With this arrangement, there will be an appreciable saving in refrigeration. Experience has demonstrated this.

The report states that previous recommendations concerning adequate insulation will have to be modified and that on lounge cars and other similar types where space is at a premium, it may be necessary to reduce the insulation thickness to 4 in., although 5 in. is recommended.

The suggestion is made that in wintertime, a steam coil may be used to temper the air coming into a refrigerator unit to insure satisfactory operation of the condenser, or a thermostat and a relay may be provided to stop the fan when the temperature of the condenser air drops to 40 deg. F. A germicidal lamp may be installed in the food compartments for the destruction of bacteria.

It is also recommended that where an a.c. motor is used with refrigerating units that they should be preferably of the 3-phase type or the permanently split capacitor type.

Consideration is also being given by several of the railroads to the use of pre-cooked, quick frozen foods. The handling of these foods would simplify the kitchen operation and eliminate losses due to food spoilage. This, however, the report states would require increase in low temperature refrigeration space.

Under the heading of Drinking Water Cooling," the committee has found it desirable to modify the recommendations and add that in roomettes where carafes are employed, it may be necessary to select a cooler having a storage tank of several gallons capacity, or install a system of circulating cold water to each room.

During the past year, there have been a number of new designs of water coolers developed and marketed, especially for railroad service. These have been adapted to meet the various special installation requirements, and while this is a highly competitive product, the report states that the units manufactured appear to be substantial and well suited for exacting railroad service.

Concerning diner refrigeration, the report states that during the past year, there have been a number of completely mechanically refrigerated dining cars placed in service. Preliminary reports indicate generally satisfactory performance, although there appears to be room for considerable improvement in the controls as well as to selection of location for installing the refrigeration units, from a standpoint of performance and servicing. Outstanding, of course, is the power requirement for such installations while operating in a train and the standby power needed on layover. The storage battery capacity under favorable conditions will only provide for a few hours' operation in case of standby power failure or train delay on line of road. There are other factors to be considered such as defrosting control, etc., but a longer period of service is going to be necessary before definite recommendations can be made. It is hoped that this can be accomplished in the next annual report.

Standardization

On the subject of standardization, the report states that the present state of the art of air conditioning on railroad passenger cars points to the need for standardization, both from the standpoint of the manufacturer and his own products, as well as between the products of several manufacturers. The committee's contacts with the manufacturers indicate that they are cognizant of this problem and for some time past have been making a concerted effort toward standardizing units of their own manufacture. Standardization to permit a portion of one manufacturer's equipment to be used with that of another would be difficult and, no doubt, costly, and would involve patent difficulties which further complicate the problem.

While the committee feels that standardization, as covered in this assignment, is highly desirable, yet the immediate prospects for an early solution are very slim. Before real progress can be made, the manufacturers are going to have to get together and determine the extent that standardization is necessary and then establish the standards to be met.

Sealed Refrigerating Units

With the trend toward a.c. power supply, and away from d.c. power for car lighting and air conditioning, the report states that the development of a large size hermetically sealed unit is highly desirable and necessary in order to derive the benefits obtainable from use of this unit and in order to derive the benefits obtainable from use of this unit and a.c. power. To date 5 hp. is the largest of the vane type units that has been built. Information now available, indicates that the manufacturers are experimenting with larger units, but the difficulties thus far encountered are such as to preclude the possibility of a unit being available any time in the immediate future. One known fact is that they are confronted with a problem of lubrication, and the ultimate success in the development of a hermetically sealed unit hinges largely on the production of a suitable lubricating oil. Present day oils are not suitable.

The committee in its investigations has learned of several large capacity (50 tons and over) sealed unit industrial installations that have given practically trouble-free service. These, however, are reciprocating type compressors. This assignment will be actively followed up as the development of suitable units for railroad service is going to add greatly to the dependability of the air conditioning equipment.

The report is signed by S. G. Peterson (*Chairman*), superintendent car department, Seaboard Air Line; G. E. Hauss, electrical supervisor, Baltimore & Ohio; A. E. Voigt, car lighting and air conditioning engineer, Atchison, Topeka & Santa Fe; J. L. McMullen, electrical inspector, New York Central; W. A. Woodworth, general inspector air conditioning and car lighting, Southern Pacific; W. J. Madden, electrical foreman, Pennsylvania; J. L. Christen, yard department, The Pullman Company;

L. E. Benoit, electrical engineer, New York, New Haven & Hartford; D. C. Houston, assistant electrical engineer, St. Louis-San Francisco.

Discussion

The report was presented by S. G. Peterson, who was superintendent car department, Seaboard Air Line, when the report was prepared and who is now service representative, Pullman Standard Car Manufacturing Company. L. J. Verbarg, air conditioning engineer, Missouri Pacific, reported that his railroad had had difficulty in satisfying the inspectors of the National Health Service. Mr. Peterson replied that his committee had not consulted the commission during the preparation of the report. L. C. Bowes, electrical engineer, Chicago, Rock Island & Pacific, said his railroad has recently placed in service a car built by Pullman in which a blower of 800 cu. ft. per min. capacity is used to ventilate the kitchen. He added that air conditioning a kitchen would be a difficult task. Mr. Verbarg said the health inspectors are requiring the closing of most openings in kitchens. R. E. Gallagher, electrical engineer, Louisville & Nashville, reported that the L. & N. employs a large exhaust fan over the range in dining car kitchens that air is taken in through filters, with some coming from the dining room and that sterilamps are used. Mr. Verbarg said the National Health service is inclined to permit no air to enter the kitchen which is not filtered. A. E. Voigt, car lighting and air conditioning engineer, Atchison, Topeka & Santa Fe, said that on Santa Fe diners, air is brought in over tempering coils during writer operation and that best results are obtained by directing incoming air to the floor and taking it out at the ceiling. Exhaust fans he said are not good, since they accumulate grease and constitute a fire hazard. The Santa Fe method, he said, causes a slight positive pressure and added that he has not heard of any protest on the part of the National Health Service. R. W. Tonning, Jr., electrical engineer, Atlantic Coast Line, concurred that a pressurized kitchen with an air curtain between the kitchen and pantry is preferable to a power-exhausted kitchen.

Mr. Peterson asked for information on water-spray type filters. Mr. Voigt replied that lack of mud in the system resulting from dirt removed from the air had been quite puzzling, but added that a considerable accumulation had been found in the water tank. He said that washing the air does not eliminate all odors, but that the air is evidently freshened. Evaporation in the spray, he said, reduces the air temperature in the car 2 or 3 degrees when trains are moving through dry climates. The objection to using sprays, he added, is that power is required to operate the pump. M. A. Pinney, assistant electrical engineer, Pennsylvania, asked if the cars operate where the relative humidity may be as much as 75 to 90 per cent. Mr. Voigt replied that they do and that when this occurs, the humidity control cuts out the water spray. He also said that the humidity control causes little trouble but does require watching.

J. E. Gardner, electrical engineer, Chicago, Burlington & Quincy, said his road has a few cars with Electro Air Mat filters made by the American Filter Company and that all new cars on order will have them. The filters, he said, are changed in much the same way as other throw-away filters. Mr. Voigt said these filters can go two or three months without renewal. Mr. Peterson said that to his knowledge they had been doing a satisfactory job.

Mr. Peterson said the refrigerators in service make no provision for fish or for defrosting. R. H. Russel, efficiency engineer, Great Northern, replied that the best procedure for fish is to receive them packed in ice and to put them with the ice into the refrigerator to retard the rate of melting. W. J. Madden, electrical foreman, Pennsylvania, said that mechanical refrigerators on P. R. R. diners have been highly satisfactory.

C. P. Smith, Frigidaire Division, General Motors, stated that when a refrigerator is equipped to make ice, it should be defrosted two or three times a week since the coils operate at a temperature of about 5 deg. F. Any dual-purpose refrigerator, he said, must have means for defrosting.

The question of maintaining refrigeration on diners in yards was raised by J. A. Bucy, supervisor, car lighting, Baltimore & Ohio. Mr. Peterson said that cars are usually kept on standby power, but wanted to know how long a closed box would remain at an adequately low temperature without power. Mr. Smith replied that with the outside temperature at about 90 deg., food will not spoil in less than 18 to 20 hours. Refrigerating load, he added, is about 2-kw. Mr. Smith then suggested that the committee should follow work being done by the Army and Navy in which they are attempting standardization which will even make pistons and rods of compressors interchangeable. W. S. H. Hamilton, equipment electrical engineer, New York Central, replied that any question of standardization must be pursued carefully since it may obstruct progress. Standardization, he said, may perhaps properly include such things as pressure switches and other auxiliary devices which would simplify the making of repairs in service. He added that the Association should draw suggestions from the maintainers. With reference to Section 7 of the report in which the statement appears that the largest hermetically sealed unit in service is rated 5 hp., Mr. Smith said, its success is dependent upon its being a packaged unit sealed at the factory and added that it might not work as well if the arrangement of equipment required piping on the car. Mr. Smith said that lubrication and insulation present problems in sealed units unless the unit is water-cooled. The internal temperatures, he said, must be kept below 200 deg. or the oil will break down, react with the freon and damage the insulation. Water cooling, he said, which works well in other applications would require about 300 gal. of water on the car. Piping, he added, introduced potential trouble in that it introduces the possibility of condensation of moisture in the system.

Mr. Wall said the air conditiong systems lost capacity in service because of accumlations of dirt and suggested that this phase of the subject be studied by the committee. Mr. Hamilton suggested study of the Radarange, for high-frequency, high-speed cooling.

Radio and Communication for Rolling Stock

The first assignment of the committee on application of radio and communication systems to rolling stock was to cooperate with Committee 4, "Radio and Allied Communications as Applied to Railroad Operations of the Communications Section. Items in the report of Committee 4 which are of particular interest to the Electrical Section include a proposed duty cycle for a transmitter as follows:

SERVICE CONDITIONS

Duty: Transmitter-Intermittent (Cycle of 5 minutes on and 15 minutes off for a period of 7 hours, and 10 seconds on and 20 seconds off for one hour)—Receiver—Continuous.

NORMAL OPERATING CONDITIONS

Line Voltage: 117 volts r.m.s., 60 cycles, single phase.

The Electrical Section report also includes a reprint from the report of Committee 4 which lists specifications for housing and mounting of communication equipment on cabooses and locomotives.

Communication Train Line

The committee has done a piece of work of primary importance in its preparation of specifications for electric train lines for communication and entertainment. These are as follows with the exception of the drawing of a plug:

Receptacles: The receptacles on ends of cars shall be as shown in Fig. 1.

The location of the receptable on the ends of cars shall be as shown in Fig. 3, of the Report on Car Electrical Equipment.

The receptacle shall be furnished with a weatherproof cover, hinged at the top on non-corrosive pin or screw and with a stainless steel spring.

The cover shall have a projection which is to engage shoulder of plug, indicated in Fig. 1, and shall exert not ess than 10 lb. axial retaining pressure on plug.

Contact assembly of receptacle shall be so constructed that it can be rotated 180 deg. for alternate (no. 2) receptacle. Back of contact assembly with leads shall be moistureproof. When specified by the purchaser, receptacle will be furnished with color coded leads or cable of length and construction as specified. Contacts shall be floating (not rigidly held in insulation). Contacts shall be of bronze material and solid. Insulation resistance between any pair of contacts and between any contact and the housing shall be not less than one megohm under normal railroad operating conditions.

The capacity between any pair of contacts and between any contact and the housing of an assembled plug and receptacle shall be not greater than fifteen micro-micro farads. The insertion and extraction force of a single male and female contact assembly shall be not less than two, nor more than four pounds, after ten insertions of a non-selective assembly.

Plugs: Contact assembly, if removable from plug housing, shall be so constructed that it can be rotated 180 deg. for alternate (No. 2) plug. Cable assembly with plug shall be waterproof and so designed as not to transmit any pulling strain to contacts. Contacts shall be female and split and shall be of bronze material. Insulation resistance between any pair of contacts and between any contact and the housing (if of a conducting material) shall be not less than one megohm.

The capacity between any pair of contacts and between any contact and the housing of an assembled plug and receptacle shall be not greater than fifteen micro-micro farads. The insertion and extraction force of a single male and female contact assembly shall be not less than two nor more than four pounds, after ten insertions of a non-selective assembly. Plugs shall release from locked-in position in receptacle, when force is applied to cable, without damage to cable, plug or receptacle.

Car wiring: All conductors and shield wires shall be of soft annealed, tinned copper wire per latest A.S.A. specification.

Separator shall be used between conductor and insulation unless free stripping compound is used.

All fabric braids to conform to latest A.S.A. specifications and to be saturated with weatherproof and flame resisting compound.

The stranding of conductors shall be not less than given below:

Wire Size	Min. Strands
No. 18 A.W.G.	16
No. 16 A.W.G.	26
No. 14 A.W.G.	19
No. 12 A.W.G.	19

All conductors shall be individually insulated with a waterproof material meeting insulation requirements of latest A.S.A. specification for class "AO", 600-volt service.

The effective capacity between the two conductors of a twisted pair shielded cable, with shield grounded, shall not exceed 30 micro-micro farads per foot.

The terminal designation, wire size and color code for wires in cars shall be as shown on Table 1.

Wire numbers 5 and 6, 7 and 8, 9 and 10, 11 and 12, and 13 and 14, respectively, shall be a twisted pair with a 60 per cent woven wire shield. Shield wire size shall be not smaller than No. 34 A.W.G. Outside shielding shall be jacketed with a waterproof and abrasion resistant material providing an insulation resistance greater than one megohm per 100 ft. between shield and water. The test shall be made at 500 volts, direct current, and after 24 hours submersion at 60 deg. F.

The color coding in Table 1 conforms to R.M.A. standard for wire numbers 2, 3 and 4, and channel numbers 1 to 5, inclusive.

Jumper Cable: All conductors and shield wires shall be of soft annealed, tinned copper wire per latest A.S.A. specification.

Separator shall be used between conductor and insulation unless free stripping compound is used.

All fabric braids to conform to latest A.S.A. specification and to be saturated with weatherproof and flame resisting compound.

All conductors shall be individually insulated with a waterproof material meeting insulation requirements of latest A.S.A. specification for class "AO", 600-volt service.

The effective capacity between the two conductors of a twisted pair shielded cable, with shield grounded, shall not exceed 30 micro-micro farads per foot.

The jumper cable shall be a spiral concentric lay assembly of seven shielded pair cables suitably jute filled or equivalent, and covered with an outer jacket of a water proof and oil, fire and abrasion resistant material. Outer jacket shall be not less than 1/16 in. thick and must be free stripping. The jumper cable shall bend around a mandrel ten times its outer diameter. The outer diameter will approximate 1¼ in. times its outer diameter.

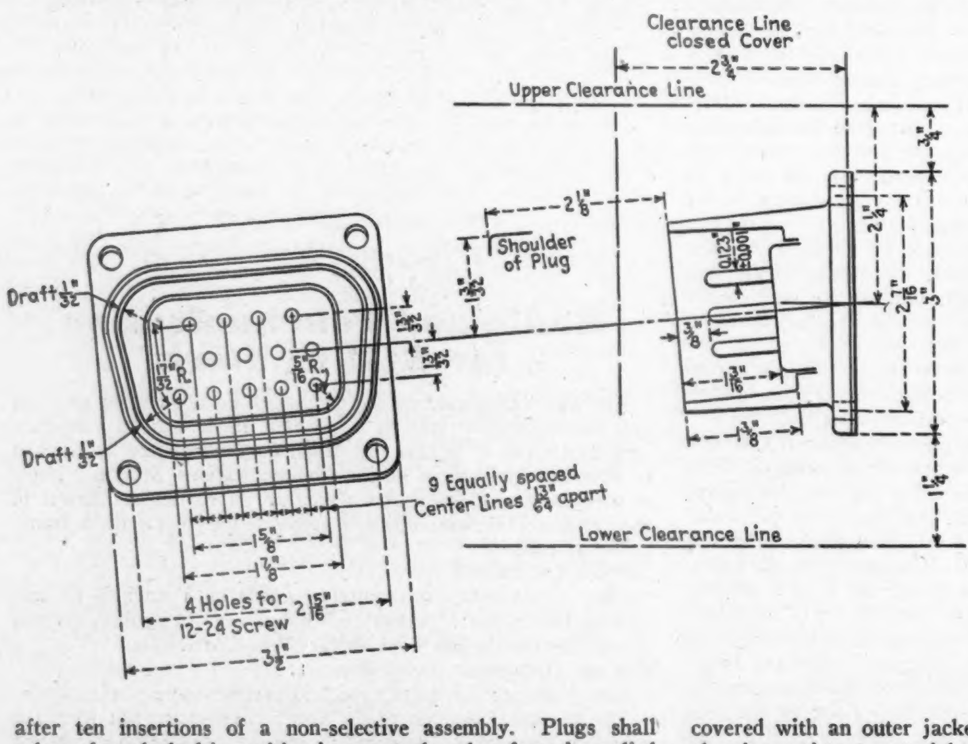


Fig. 1—Electric train line receptacle for communication and entertainment—The location for these receptacles is shown in Fig. 3 in the report of the Committee on Car Electrical Equipment

Table 1

Circuit in No. 1 Receptacle	Terminal No.	Minimum Wire Size (A.W.G.)	Color Code	Circuit in No. 2 Receptacle
Shield Common	1	......	......	Shield Common
Control Negative	2	No. 12	Red	Battery Positive
Control	3	No. 12	Orange	Battery Negative
Control	4	No. 16	Yellow	Control
No. 1 Channel Entertainment	5	No. 18	Brown	Control
	6	No. 18	Black	Control
No. 2 Channel Entertainment	7	No. 18	Red	Voice Channel
	8	No. 18	Black	Telephone
No. 3 Channel Entertainment	9	No. 18	Orange	Spare Channel
	10	No. 18	Black	Entertainment
No. 4 Channel	11	No. 18	Yellow	Spare
P. A. Input	12	No. 18	Black	Spare
No. 5 Channel	13	No. 18	Green	Spare
P. A. Output	14	No. 18	Black	Spare

Each shielded pair cable shall be made up of a twisted pair of No. 16 A.W.G. conductors with a 60 per cent woven wire shield over the twisted pair. The conductors shall have not less than 65 strands per conductor. The shield wire size shall be not smaller than No. 34 A.W.G. The shield shall be covered with an abrasion resistant material of not less than 0.0125 in. thickness to insulate adjacent shields electrically and mechanically.

The terminal designation and color code for conductors in jumper cable shall be as shown in Table 2.

The color coding in Table 2 conforms to the color coding in Table I.

The assembled jumper cable with plugs shall be 69 in. overall.

Table 2

Color Code of Conductors in Twisted Pair, Shielded Cables	Conductor Connects to Terminal No.	Shield Connects to Terminal No.
Red	2	..
Red	2	
Orange	3	4
Orange	3	
Brown	5	1
Black	6	
Red	7	1
Black	8	
Orange	9	1
Black	10	
Yellow	11	1
Black	12	
Green	13	1
Black	14	

Caboose Power Supply

A questionnaire asking for data on train communication was sent to a number of railroads having permanent installations. It disclosed the facts that a large majority of caboose power systems employ axle generators, that a few use engine generators, and that there are very few straight storage battery systems. In response to questions asked of engine builders, it was learned that at present their policy seems to be to use stock equipment rather than develop something specifically to meet operating conditions. This, the report states, will probably change as demand increases.

Very general specifications for the installation of train communication equipment are included in the report. Probably the most significant of these is No. 9, which reads, "The use of gasoline or propane engine-driven generators should be completely avoided as a source of power inside buildings or rolling equipment."

Specifications for Entertainment Receivers

Quite complete specifications for radio receiving sets used for entertainment on passenger cars are included in the report. They disclose the fact that the average stock receiver is not rugged enough to stand the continued shock and vibration encountered in train service. They also state that in railroad service the a.c. receiver may be used, but that it has disadvantages, compared with a d.c. receiver, in that it requires conversion equipment which is only about 50 per cent efficient,—that the large power demand requires that power be taken from the unregulated supply,—that extra filtering is required and that since high receiver voltages were used, the life of resistors and capacitors was relatively short. This latter objection applies also to high-voltage type d.c. receivers. Because of these facts, it is recommended that the "low-voltage type d.c. receiver" be given first consideration in the selection of equipment.

Two types of antennas are suggested. One of these is a closed loop made of neon sign cable with 15,000-volt insulation, and the other is a "T" type antenna consisting of a ¼-in. copper rod, of specified length, covered with a one-inch diameter extruded plastic sheath having a nominal 100,000-volt insulation value.

The recommended method of eliminating interference from generators, motors and fluorescent lights consists broadly of the use of condensers and filters, the values for different applications being given in the report.

It is strongly recommended that maintenance of equipment be concentrated at one point if possible and it is suggested that the central repair shop should be equipped with instruments as follows:

A good signal generator

An Oscilloscope, either 3 or 5 inch

A vacuum-tube voltmeter

A signal tracer, several good models of which are obtainable

An ohmeter

A condenser analyser

A high resistance a.c./d.c. voltmeter with a decibel scale

A test speaker having a universal voice coil transformer to match any tube output or line impedance and a variable choke coil to take the place of a dynamic speaker field coil in a set thus equipped.

For transporting equipment to and from the central repair shop, it is recommended that special shipping boxes be provided for receivers, speakers and rotaries to prevent breakage in transit.

Concerning inspection, the report states that each car should be inspected on arrival at terminal for defective equipment. A report card filled out by the attendant on the car should show any trouble encountered en route. Radio should be played and any poor quality rectified, if possible to do so by changing a defective filter condenser on car equipment or tube in receiver. If necessary, defective receiver is to be removed and replaced. If report card shows noise when car is moving, the generator filter condensers should be checked and replaced if necessary. Check receiver with all blowers and fans running, and, if noisy, cut off fans one at a time until the offender is located, when it can be filtered or its commutator or other defective parts repaired.

The report is signed by R. I. Fort (*Chairman*), assistant research engineer, Illinois Central; J. A. Bucy, supervisor car lighting, Baltimore & Ohio; F. E. Gould, equipment inspector, New York Central; W. S. H. Hamilton, equipment electrical engineer, New York Central; R. A. Harrington, engineer train lighting, Chicago, Milwaukee, St. Paul & Pacific; W. S. Heath, assistant electrical foreman, Atchison, Topeka & Santa Fe; N. A. Passur, assistant engineer car construction, Southern Pacific; L. J. Verbarg, air conditioning engineer, Missouri Pacific.

Discussion

The report was presented by R. I. Fort, assistant research engineer, Illinois Central, W. S. H. Hamilton, equipment electrical engineer, New York Central, proposed a special vote of thanks to the committee for the work it has done, saying it is an outstanding achievement. Mr. Fort added that the committee required and received the full cooperation of all the manufacturers involved. These he said were the American Phenolic Company, The Pyle-National Company, the Albert & J. M. Anderson Manufacturing Company, the General Cable Corporation, the Cannon Electrical Development Company, the American Car and Foundry Company, and the Pullman Standard Car Manufacturing Company.

In connection with the question of power supply for train communication, R. C. Lewis, chief engineer and manager railroad division, Spicer Manufacturing Company said, his company has been working on a 3-kw. for baggage cars, mail cars, cabooses, etc., (these are described in the September 1947 issue of *Railway Mechanical Engineer*). There are several of these drives in operation, he said, some of them having acccumulated as much as 50,000 miles of operation. He said they have developed some minor troubles, but expect that they will soon be disposed of.

Mr. Hamilton said the committee should not lose sight of the possibilities of a 12-volt caboose power system, until more is known about the overall problem.

R. E. S. M. A. Elects Officers

A business meeting of the Railway Electric Supply Manufacturers Association was held on Wednesday morning, October 1, 1947, in the Grand Ballroom of the Hotel Sherman, Chicago. The following slate of officers was elected:

President: ***L. A. Spangler, Westinghouse Electric Corporation, Chicago.***

Senior Vice President: ***G. B. Miller, Loeffelholz Company, Milwaukee, Wisc.***

Junior Vice President: ***B. G. Durham, Albert & J. M. Anderson Manufacturing Company, Boston, Mass.***

Director (for three years): ***W. M. Adrian, Luminator, Inc., Chicago; W. A. Ross, Pyle-National Company, Chicago; A. E. Swedenborg, Benjamin Electric Manufacturing Company, Des Plaines, Ill.***

Combustion Air for Fireboxes*

By Fred D. Mosher†

A discussion of the use of an Undergrate Air Distributor as a means of improving combustion efficiency in locomotives

The steam locomotive air-handling system is one which operates without controls or dampers of any kind. The exhaust nozzle, which is the only means available for providing combustion air, is a fixed device, and, like similar devices, its ability to do work efficiently is decreased as its load is increased. This characteristic of the exhaust nozzle imposes certain limitations on the locomotive as a power plant.

While the air-flow characteristics for all locomotives are not identical, they are similar in that at some point on the load curve the draft system becomes incapable of supplying enough air to burn the coal necessary for further increases in power output. In the curve shown in Fig. 1 the air supplied in relation to the air required is quite satisfactory below a drawbar horsepower output of 2,000. Above the 2,000 db. hp. point the curve changes so that at 3,000 hp. the correct amount of air with respect to the coal fired is no longer being supplied. As the air supply falls off the combustible loss increases and finally a point is reached where the combustion process does not produce any "net" evaporation. This means that some point is reached, which is less than potential capacity, where no increase in cylinder horsepower can be obtained because of combustion limitations.

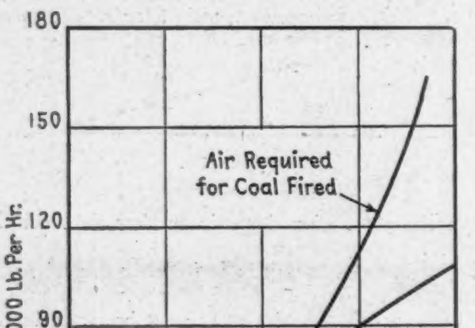


Fig. 1—Relation of weight of air supplied to air required for combustion

In a locomotive firebox, as in all combustion furnaces, heat is released by the chemical union, at high temperature, of carbon and hydrocarbon from the fuel with oxygen from the air. To make conditions favorable for combustion it is the practice to supply "excess air" or a total air quantity somewhat in excess of the theoretical amount required for combustion. In the locomotive this percentage of excess air above the theoretical requirements falls off very rapidly as the drawbar horsepower is increased. Fig. 2 shows a typical excess air curve versus drawbar horsepower for a conventional locomotive.

There is some misunderstanding with respect to the term "excess air" in discussing combustion in the locomotive firebox. The term is not one to be applied generally. When air is supplied to the grates in excess of that required for combustion it is quite properly considered as excess air. When, however, gas analyses show that combustion is incomplete while oxygen-carrying air is present the unused air passing out the stack cannot be excess in the strict sense of the term, and, as Fry[1] has indicated the name for this air ought to be "unburned air."

Unfortunately, a kind of law of diminishing returns operates in the locomotive combustion process so that at the higher rates the unburned fuel loss increases rapidly. This means that supplying additional air beyond a certain rate of combustion does not necessarily improve performance. But in seeking a means of improving combustion efficiency the air supply problem and the utilization of the available air have a number of attractive possibilities. The locomotive firebox combustion process is well understood as are the limitations. But methods of improving conditions with respect to air supply and

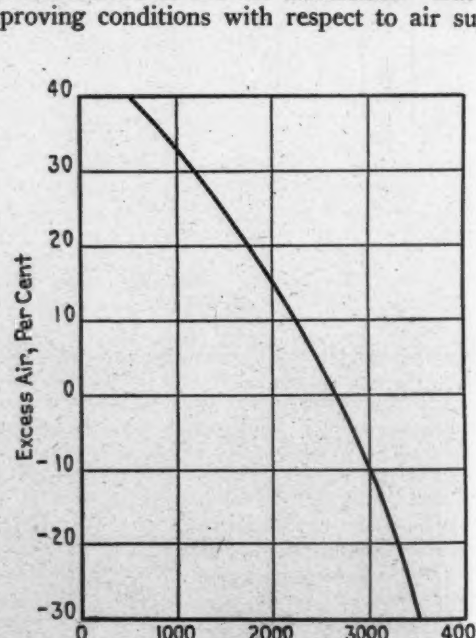


Fig. 2—Excess air versus drawbar horsepower

* An adaptation of a paper presented at the fortieth annual meeting of the Smoke Prevention Association of America, Inc., on July 9, 1947, at Toronto, Ontario, Canada.

† Research engineer, The Standard Stoker Company, Erie, Pa.

[1] Lawford H. Fry, director of research, The Locomotive Institute, New York. See article entitled "Fire—Air—Water", page 564, *Railway Mechanical Engineer*, December, 1944.

control have not been given as much attention as they warrant. The possibilities for dividends are very great.

Those who operate coal-fired locomotives, as well as those who supervise road operations of locomotives, are well aware of the high burning rates that take place in the rear portion of the firebox when locomotives are under load. The air flow to the grates follows the path of least resistance and the greatest volume of air passes through the grates in the region under the arch. It is here that the high velocities, conducive to cinder carry-over, develop. More coal is burned on this rear portion of the grate as a consequence of the high demand for fuel that results and the ease with which coal can actually be furnished to this portion of the grate.

In recent years studies of the air flow pattern into the ashpans of moving locomotives have been made and it has been found that the favorable conditions for concentrated air flow to the back portion of the grates is further aggravated by the motion of the locomotive. At the higher speeds the air flow is concentrated at the back portion of the ashpan due to the piling up effect caused by the backward flow of air past the ashpan air opening. Assuming the path of the air into the ashpan is at right angles to the path of air in the backward flow past the ashpan air opening, the resultant air flow through the ashpan air opening is of some magnitude greater than the normal flow and at some angle giving it direction to the back portion of the grates.

In tests conducted on several railroads, it was found that a system of baffles, properly designed, installed in the ash pan air openings would break up the air-flow pattern referred to and redirect the air in such a manner that all portions of the underside of the grate would be adequately supplied with air. The system of baffles, called the Undergrate Air Distributor[2] has been applied

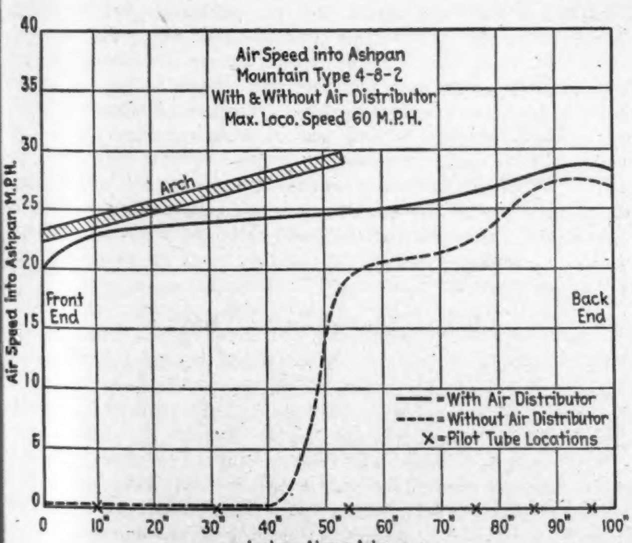


Fig. 3—Air-flow pattern in ashpan

to a large number of locomotives and its use is being currently extended.

Fig. 3 shows an average air-flow pattern in the locomotive ashpan as checked by Pitot tubes with and without the ashpan air distributor. These readings are of velocity only and do not reflect the quantity of air being supplied to the firebox. However, actual dynamometer car tests show a reduction of cinder loss of from 7 to 15 per cent with the air distributor. Laboratory tests with a model firebox confirm the effect of baffles on air flow to the firebox.

[2] The Standard Stoker Company, 350 Madison Avenue, New York, is the exclusive licensee of the Undergrate Air Distributor. The distributor was described on page 1294D208, June 26 issue, *Railway Age*, Daily Edition.

In the actual design of the air distributor, factors to be considered are grate area, furnace volume, gas areas, and the air opening into the ashpan. In order to design the distributor correctly each class of locomotive must be studied separately because of variations in conditions with respect to ashpan, arrangement, etc.

By redistributing the air to the ashpan, or more correctly, by correcting the maldistribution with the baffle system the available furnace volume under the arch is made more effective since more burning is done under

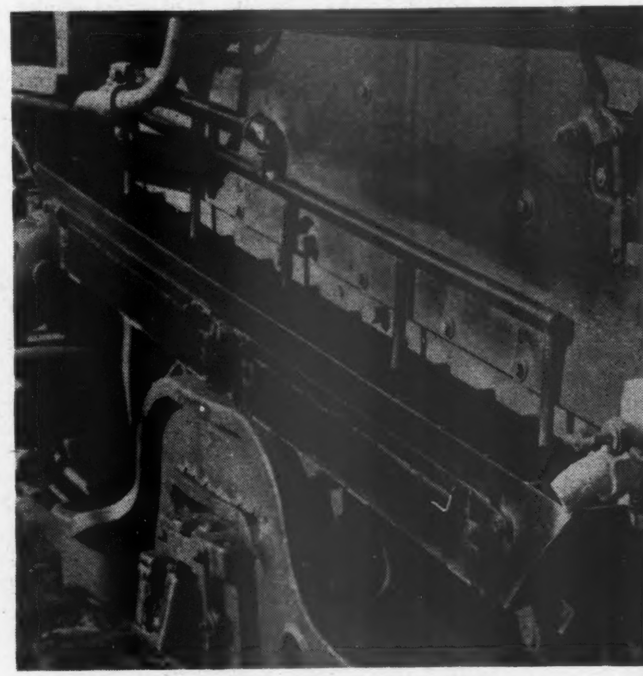


Fig. 4—Undergrate Air Distributor applied to a 4-8-2 locomotive

the arch and there is a reduction of the burning rate on the back portion of the grates; coal delivered to the forward portion of the grates receives more combustion air, and the net result is, as tests have shown, a reduction in the unburned carbon loss and consequently improvement in the combustion efficiency.

Fig. 4 shows an application of the Undergrate Air Distributor to a 4-8-2 locomotive. The baffles are disposed in a sloping trough so that each baffle is raised into the air stream somewhat higher than the one immediately preceding it. The best applications are made where there is a minimum of interference from piping along the sides of the ashpan and immediately above it.

At the lower speeds (by test about 12 miles per hour) the Undergrate Air Distributor has no appreciable effect on air distribution to the ashpan; it is essentially a device for performance improvement in moderate to high speed operation. There are no advantages in using it in yard service, for example. While it is a secondary consideration, it has been found with some locomotives that the application of the distributor has permitted the use of a larger exhaust nozzle.

The question has been raised as to whether a distributor could be designed to give optimum performance at some optimum speed of the locomotive. Experience so far has not provided sufficient information for the basis of such a design.

In use on extended runs in passenger-train operation, the Undergrate Air Distributor has allowed longer runs between fire cleanings with high ash coal. While no fuel bed temperature readings were taken during these runs, it was found that clinkering was minimized, appar-

(*Continued on page 645*)

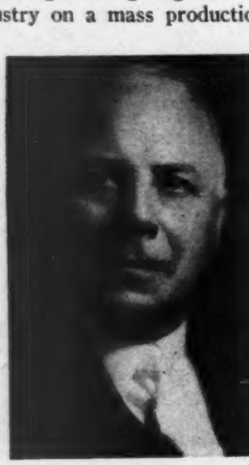
Man Power Vs. Machine Power*

By Roy V. Wright†

The best of tools are useful only when in the hands of workers in full sympathy with the aims of their employers—Man the vital factor, not the machine

We have been progressing at such a rapid rate, from an economic standpoint, and there has been so much turmoil because of the disrupting influence of two World Wars that we seem to have lost our perspectives and must make an earnest effort to get back to fundamentals. The difficulty is that the results of scientific and engineering advances, together with the mass production era, all concentrated within a comparatively short period of time, have so complicated our existence and relationships that it is not an easy or simple task to recognize these fundamentals.

A century ago life in this country was comparatively simple and our people, with plenty of elbow room and unexplored frontiers, managed to get along together fairly well. Today, the growth of industry on a mass production basis, with vastly



Roy V. Wright

improved communication and distribution methods, has tended to concentrate our populations in metropolitan and industrial centers. Moreover, because of the application of science, machinery and business methods to farm production, a comparatively small part of our population is now required to supply all the food that we need. The net result is that as individuals we have become high degree specialists in our tasks and have thus lost much of our economic independence; we are truly interdependent.

Long Step From the Primitive

Unfortunately, our advances in science, engineering and business administration have not been paralleled by those in the social sciences. It is much less than two centuries since Watt perfected his steam engine in 1776, and thus started an era in which the efforts of the individual have been supplemented more and more and greatly multiplied by mechanical power. Human beings, on the other hand, have been living with each other for many centuries, yet today have only an inadequate conception of how to co-operate constructively in taking advantage of our material and economic advancement.

Until the development of the steam engine man did his work manually, with only a few comparatively simple tools. He did know how to utilize wind and water power to a slight degree and his efforts were also supplemented by animal power. Today each worker, on the average, has at his command many horsepower, and behind him is a large investment in plant and machinery.

As Americans we take great pride in these achievements and the resulting high standards of living, with opportunities for leisure, self-improvement and recreation. On the other hand, because of our ignorance about how to work together as human beings, we are bungling things badly, and losing many of the advantages that we should gain from technological advances. Indeed, we may not be able to retain all of those we now enjoy. We have been so absorbed in material advancement that we have lost sight of certain vital factors which control the maintenance of the prosperity and well-being of our nation.

Machinery Is Controlled By Men

After all, these great industrial and transportation facilities with their machinery and equipment are operated and controlled by human beings. Unless the workers have a sympathetic appreciation of the problems of their employers, unless they feel that they have a common interest with the employer and are an important and essential part of the organization, they can to a greater or less degree destroy the value of this machine power to the community and to themselves. This suggests that the management has a large responsibity to educate employees to the conditions with which its particular business is confronted, what the actual facts are as to its operations, and how they may best co-operate to their mutual advantage. It must be recognized, also, that a large proportion of the workers have only limited educations and the facts must be so expressed that they can easily grasp them. Learned discussions and intricate explanations are of little use in such instances.

Fortunately, many leaders, in widely varying fields of endeavor, have become aware of the grave dangers which beset us in this era of human relationships. Interestingly enough, approaching the problem from quite different angles, they seem to tend to certain common conclusions. Let us examine some of these approaches.

What Eisenhower Thinks

As a military leader and administrator General Dwight D. Eisenhower is certainly tops. Listen to his challenge to us in the closing sentences of his address to the American Legion Convention in New York, on August 30.

"The thought I leave with you is this: *The American system rests upon the rights and dignity of the individual. The success of that system depends upon the assumption by each of personal, individual responsibility for the safety and welfare of the whole.* (The italics are ours.)

"No government official, no soldier, be he brass hat or pfc, no other person can assume your responsibilities—else democracy will cease to exist. They are yours, to meet or neglect! In the one direction lies first our immediate and future safety. Beyond that are all our aspirations, our hopes for ourselves and our children. In the other direction lies the destruction of all we hold dear."

Infinite Value of Individual

Again, our spiritual leaders have long stressed the brotherhood of man and the so-called Golden Rule. Christianity and our American representative form of government have much in common. President Harold W. Dodds, of Princeton University, has expressed it in this way: "The democratic ideal is the Christian ideal, because it alone accepts Christ's emphasis on *the infinite value of the individual.* (The italics are ours.) His message envisioned freedom in religious terms long before

* An address presented before the meeting of the Locomotive Maintenance Officers' Association held at Chicago September 16 and 17, 1947.
† Editor, *Railway Mechanical Engineer.*

democracy took a political form, or science and technology appeared to help set men free."

This appreciation of the importance of the individual was written into the Constitution by our forefathers, and today, although we have not done as good a job in applying the principle as we should have, it distinguishes our nation from most others, and is responsible for its greater strength and stability.

Human Relations in Industry

With this conception of the significance of and place of the individual in our American system, let us consider its implications in human relations in industry and transportation. For many years a Conference on Human Relations in Industry has been held at Silver Bay, on Lake George in New York. A large group of men from industry have earnestly sought to find solutions to those problems which have caused unrest and misunderstanding in labor-management relations. The committee charged with the responsibility for building the programs has been composed of men occupying important positions in industry and ultimately in touch with its human relations phases.

Because of the constructive manner in which these conferences have been conducted, they have had a wide influence on improvement in relations within industry. It is signficant, therefore, that after months of study and discussion, the committee decided that the most appropriate theme for 1947 meeting would be, "Better Relations Through Better Understanding."

I should like to comment briefly on three impressions I gained that may be helpful in our discussion here.

1. It is essential that supervisors be taken into the full confidence of management. The supervisors and foremen come in direct contact with the workers. They should be fully and currently informed as to the company's policies and plans. This will equip them to dissipate inaccurate and erroneous reports and rumors, which, if allowed to stand, may do much to distract the attention and loyalty of the workers. This is particularly true of the railroads, which as public utilities, are particularly vulnerable to the whims of politicians and self-seekers. Then, too, the railroad forces are widely scattered geographically, which makes the distribution of accurate and adequate information even more essential.

Unfortunately, because of the lack of proper contacts and channels, many foremen and supervisors feel more or less on the outside, and therefore cannot exert a proper influence on the workers. These facts are becoming more widely recognized, but only a few leaders have made real progress in solving the problem. It is of first importance, however, and must be tackled with real vision and determination. Pioneers have blazed the trail.

2. Equally important is the responsibility of management to educate the workers. Management simply cannot afford to sit idly by while the workers and the public are being continually subjected to propaganda, some of it malicious, that is based on inaccurate information, which should be challenged and offset by the real facts. In discussing this question at the Silver Bay Conference, Maurice R. Franks, national business agent and editor of the Railroad Yardmaster, made this statement:

"Without subterfuge, workers should be made acquainted with the trials and tribulations of the business, with the nature of risk and the nature of both penalty and reward. The worker, by natural law, shares the risk; the reward should be theirs without the asking so that penalties may be shared without complaint. Thus treated, the American workingman, being of fair and honorable mind, will take the bitter with the sweet. He can and will do this, however, only when the way of co-operation is a two-way street, in whose traffic he may rightfully be called on to exercise his full responsibility."

3. There is much misunderstanding about the relationship between wages, prices and profits. Technical discussions by learned economists are confusing and hard, or impossible, to understand by the average layman. There are, however, certain simple principles which we should all comprehend, and this is particularly true of men in supervisory positions, who should be in a position to discuss these matters with the workers and help them to get a proper appreciation of the inter-relationships. There are two books that I would like to recommend.

One of these is "How We Live",[1] by Fred G. Clark and Richard Stanton Rimanoczy. For a number of years these two men conducted a radio quiz debate designated, "Wake Up America!", in which they brought together liberals and conservatives "to dissect and analyze the roots of America's economic controversies". With this background, and recognizing the fact that any discussion to be helpful to most of us would have to be presented in simple terms, they prepared this economic discussion with its simple understandable illustrations, and containing less than 5,500 words—words so simple and understandable you will not have to refer to a dictionary. It has had a wide distribution, at least one large railroad supplying a copy of it to each of its officers and supervisors.

Another book is "Economics in One Lesson"[2], by Henry Hazlitt, the well-known economist on the editorial staff of the New York Times. He selected certain economic fallacies which, as he points out, are at least so prevalent that they have almost become a new orthodoxy, and then carefully analyzes them. In this way the sound, basic principles of economics are bared and thrown into distinct relief.

From the Engineer's Viewpoint

We have approached this human relations problem from the viewpoint of a great military genius; from that of a leading educator, who in his early career specialized in economics and political economy; and from a conference of men from industry, specially interested and versed in human relations in that area. One could go on indefinitely, but it may be well, also, to consider the problem from the engineer's viewpoint.

John A. Patton[3], a management engineer, in a paper before the American Society of Mechanical Engineers[4], said that, "Management—like it or not—still must carry the main burden of creating and maintaining good labor relations."

In the course of his presentation he made this further comment: "The worker today is still suspicious of the ability of the technological advance to provide more jobs. Workers are poorly informed on such things as where jobs come from, the ratio of profits to wages, or the issues involved in full employment, annual wages, etc. We might ask ourselves, why such conditions of misinformation and ignorance persist, when so much depends upon public understanding of the economic facts of life. The gravity of the situation becomes more obvious when we realize that a well-informed employee has the best chance of being a satisfied employee. He wants to belong. Knowledge of what is going on makes him feel a part of the operation. His sense of security is increased almost in direct proportion to the amount of information he receives regarding the circumstances which bear about him and his particular position with the company."

After telling what a number of different companies had done to solve the problem, Mr. Patton summed up the common denominator of their programs as follows:

"1. Top management has recognized the importance of the individual and above all has convinced him of it.

"2. The programs allow the employee to be heard, as well as management.

"3. Instead of making it a one-man job, they have made it the responsibility of every executive, supervisor, and foreman.

"4. Each program has been a continual job, utilizing every available means to get it across, including meetings, pictures, magazines, and newspapers.

Stating it in another way, the secret of a successful employee relationship is a sincere desire to do a job, backed up by concentrated effort of every management man."

Summing Up

I would not for a moment deprecate the marvelous technological advances that have been made, or the splendid machine tools and equipment that have been devised for railroad shop use. The best use of these tools, however, can only be made when the workers are in full sympathy with their employers and co-operate on the most intelligent basis. Otherwise their usefulness may be minimized or entirely lost through indifference and misuse. Man is the vital factor—not the machine—and we must focus our attention and energies on helping him to develop to his full stature, in accordance with the philosophy of our American system, as expressed in our Constitution.

[1] Published by D. Van Nostrand Company, Inc., 1944, New York.
[2] Published by Harper & Brothers, 1946, New York.
[3] President, John A. Patton Management Engineers, Inc., Chicago, Ill.
[4] Human Behavior in Employee-Employer Relations, Mechanical Engineering, September, 1947, page 743.

The Cracking of Boilers*

A study of the nature of cracking at riveted seams and other places in the boiler with some conclusions as to the means for dealing with this complex problem

The cracking of locomotive boilers in the riveted seams has been a source of expensive trouble to the railroads over a period of many years. Cracking was less prevalent in the earlier years when boilers were smaller and maximum pressures were seldom more than 200 lb. per sq. in. Modern riveted steam locomotives constructed of either alloy or carbon steels with larger boilers and higher operating pressures have been seriously affected by the cracking at riveted seams and other places.

From reported past experiences it is found that none of the steels, either alloy or carbon, have escaped this problem of cracking. Practically all of the more modern designs of steam locomotives have been involved in cracking of riveted seams. It is also realized that this subject is now, and has been one of research investigation. Your committee feels that not until such research projects are completed will full information be developed so that a complete solution for the cracking at riveted seams and other places may be had.

Ray McBrian,
Chairman

As previously reported in the proceedings of the association the solution to the problem of intergranular cracking or embrittlement through the use of proper water conditioning, as was outlined by Dr. W. C. Schroder, of the U. S. Bureau of Mines, appears to have solved for a number of railroads this particular type of cracking.

Your committee recognizes that this has been a most important and major factor in retarding and eliminating this serious problem of intergranular cracking. However, in the obtaining of an understanding of the complete problem, it is necessary that full information be gained as to the full nature of all cracking in locomotive boilers at riveted seams and other places. The manner of presenting this information can best be offered in the examples that have been found in the studies of materials removed from various locomotives operating in the United States. These studies have included both the alloy and plain carbon type and have included practically all materials specified.

* From a committee report presented at the meeting of the Master Boiler Makers' Association held at Chicago September 15 to 18, 1947.

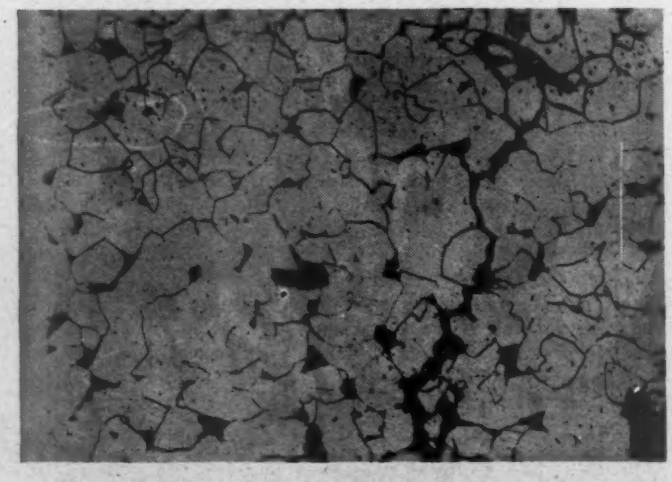


Fig. 1—Example of intergranular cracking found in riveted seam

These studies have proved that in considering materials for use in locomotive boilers as well as fireboxes, it must be realized by the designers and material specifiers that the simultaneous loading or action of mechanical loading, elevated temperatures, thermal stresses resulting from variations in temperatures during actual operations, cool down periods, react upon materials differently and that in the railroad service the most severe conditions which can be imposed is found. Records to date indicate that service failures occur in all of the specified materials due to these operating conditions of variable cyclic and thermal stresses, and their effect on changes in properties of the material. No one material has been found which will meet all of the requirements so as to not be affected by these operating conditions and changes of the properties of the materials under the variable cyclic and thermal stresses.

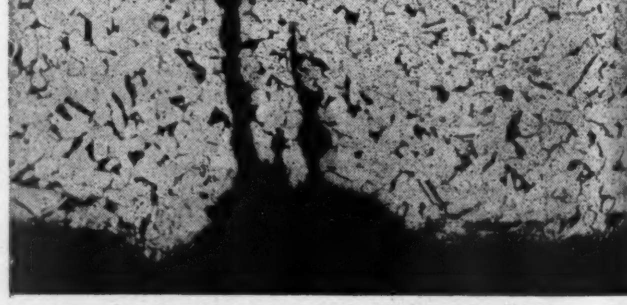


Fig. 2—Example of transcrystalline cracking starting in cold worked edge of rivet hole

It has been found that the failures in riveted seams and other places are evidently due to factors complex in nature involving such factors as temper brittleness and aging of the material, fabrication stress and stress raisers, operating stresses and shocks at the temperatures of operation, fatigue failures, intergranular embrittlement or corrosion, and other inherent properties of the materials, and effects of design.

Kinds of Failures

It is then most important and vital to first properly evaluate and study each failure as to the effect these various complex factors contributed to the failure so that some advancement may be made

in the solution. The examples cited in this report will deal with both the alloy and carbon steel grades as specified for locomotive boilers. In such studies the first step is to properly classify the type of cracking which has occurred, that is if it is that of the intergranular or embrittlement type, or if it is transcrystalline in nature. Typical examples as found in studies are given in Figs. 1 and 2.

It should be mentioned that in these investigations identification as to the type of cracking is based upon metallographic study of

Fig. 3—Type of cracking found in lap joint

the entire length of crack. Where the study under the metallograph shows that from 90 to 100 per cent of the entire length of the crack is intergranular, the failure is then classed as intergranular embrittlement.

Where the entire length of crack is found to be 90 to 100 per cent transcrystalline the failure is classed as transcrystalline or of a mechanical nature, meaning that possibly either fatigue or a blue brittle fracture originated from the combination of the presence of stress raisers and operating stresses.

Where the study under the metallograph finds that the entire length of cracking is of a combination of both intergranular and of transcrystalline type the problem is then known to be one involving mechanical stresses and stress-raisers which also have permitted seepage and concentration of boiler water resulting in embrittlement. Studies must then be made to secure proper water conditioning and mechanical condition.

Causes of Cracking

The complexity of the problem is determining the factors for riveted seam cracking and in securing a solution may best be illustrated in this representative study. Figs. 3 and 4 illustrate the transcrystalline type of cracking.

The failure of this boiler steel at the riveted seams resulted from these interlocking factors: (1) Tool marks left in rivet hole from fabrication; (2) Fatigue cracks originated in these tool marks; (3) Steel aged blue-brittle in operating temperature range, and (4) Localization of service shock and stress ahead of low-pressure cylinder developed fatigue crack and subsequent blue-brittle fracture.

The failure originated in the development of fatigue cracks.

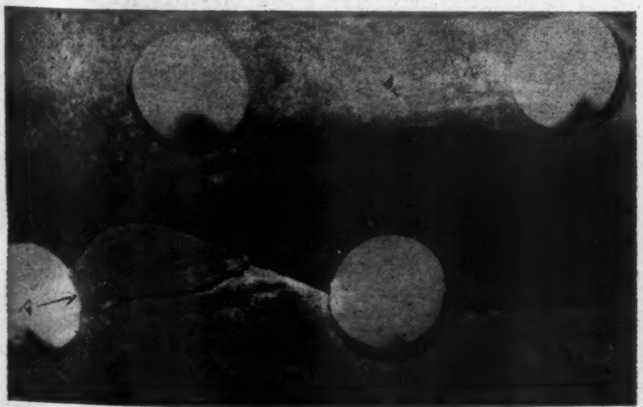


Fig. 4—Close up of cracked area shown in Fig. 3—Cracked-out section at A was formed by shear stress in an aged steel

The fatigue was created by the repeated shocks that the boiler receives. The fatigued steel was localizd to the under part of the lap joint just ahead of the low-pressure cylinders and the crack was confined to that region. The fatiguing of the steel with the gradual accumulation of undistributed stress produced aging of the steel. This aging steel, operating in the blue-brittle range, developed fatigue cracks which were accelerated in their development by the presence of the reamer marks. The temperatures in which the boiler operated made the steel susceptible to the effects of the pounding the boiler received in service as in the blue brittle temperature range the steel has abnormal brittleness characteristics and lowered ductility properties. All of these effects are additive and when repeatedly combined develop the localized failure which was represented in this specimen.

Failure was caused by the development of localized stresses which resulted from the effects of the repeated shocks that the boiler received in service. These shocks produced a fatigued and aged steel which eventually failed from a shock break after a series of fatigue cracks had developed in the rivet holes. The reamer marks hastened the formation of the fatigue cracks.

This study confirms the importance of the necessity for the complete elimination of such defects which act as stress raisers and initiate the failure in combination with service stresses. Other examples of the types of stress raisers found in studies of failed locomotive boiler seams are illustrated in Figs. 5 to 8, inclusive.

The mechanism of tool marks causing fatigue cracks is explained on the basis of shear stresses. Assume a piece of steel having tool marks is subjected to a tensile stress. This causes the piece to elongate in the tensile direction and to contract in all

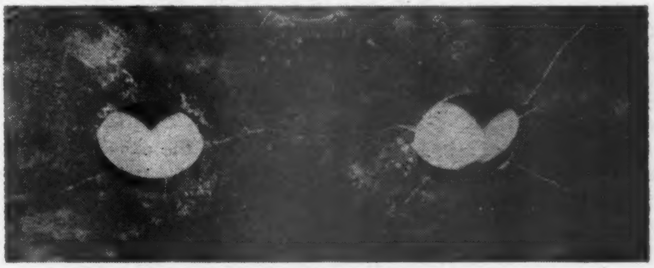


Fig. 5—Cracking in countersunk rivet holes as a result of sharp corners at edge of holes and of tool marks

lateral directions. In a tool-marked section the volume between marks is free of such movement; however, at the base of the tool marks the no-movement volume is adjacent to metal that is trying to move. This subjects the larger mass to tension forces at right angles to each other.

Due to these tension forces, the shear stress now formed at the root of the tool mark causes deformation to take place rapidly. The deformation causes cracks to develop which after starting localize at the root of the tool mark. Thus the sharper and deeper the tool mark, the sharper the effect.

From the study of this failed material, the crack originated at the sharp edge or rim of the rivet hole. These cracks were initiated by the extremely high stresses in the matching row of rivet holes. From examination it appears that the curvature was greater in the roof sheet than in the wrapper sheet. This excessive curvature in one sheet of the joint caused incomplete bearing across the joint. In an effort to overcome the lack of complete contact between the sheets, excessive caulking was resorted to, resulting in a caulking ridge between sheets approximately 1/16 in. high. This ridge caused the rivets in the nearest hole to act as levers in transmitting any movement from one sheet to another. The transmitted force assisted by the sharp rims of the rivet holes acting as stress raisers caused the steel to become aged and to ultimately crack along the pattern line as shown.

Important Shop Procedures

The summary of the views of the members of the sub-committee reports that fabricating practices and resultant stresses are largely held responsible for the conditions which ultimately result in the cracking of boiler shell at riveted seams and other places. Some of the practices held most important for consideration are: Plates not fitted up metal to metal before riveting; sharp edges not removed at rivet holes before riveting; improper caulking of plate edges, and fabricating abuses of plates, caused by improper heating and the impracticability of stress relieving.

One railroad, which had experienced cracking of boiler shells especially around the rivet holes, instituted careful control of fabrication practices and stress relief after fabrication. These

steps were taken to eliminate, as far as possible, conditions in forming, drilling, reaming, edging and riveting which were conducive to the starting of cracking. While it has been difficult to accurately evaluate all these measures they do indicate that after six years material improvement has been made in the fabrication of carbon steel shells. These practices are:

(1) Where possible, plates are sheared to size, the edges planed, and all tool marks removed by grinding. If an acetylene torch is used for cutting the sheets, a minimum of 1/8 in. of metal is afterwards removed by chipping and then all tool marks are removed by grinding.

(2) The sharp edges of rivet holes are removed by providing a fillet.

(3) At the beginning of the rolling operation, the ends of the plates are supported by an overhead crane to prevent bending of the plate at the rolls due to the long overhang.

(4) After rolling the plate into a cylinder and before applying the welt straps, the course is stress relieved by heating to a temperature of 1140° F., holding one hour per inch of thickness and then cooling down in the furnace.

(The furnace for stress relieving is fired by four oil burners at the bottom. Temperature readings are taken at 14 points by thermocouples, two of which are connected to a recording pyrometer to provide a permanent record. The furnace is a cylindrical shell of firebox steel, 20 ft. high and 12 ft. outside diameter, lined with a 9-in. wall of insulating brick. Foundation is cement overlaid with firebrick. The top and part of side of furnace lift off to permit entrance of the boiler course to be treated. The boiler is supported on four equally-spaced rails embedded upright in the concrete foundation and topped with steel channels.)

(5) Care is used in fitting all seams to get the metal-to-metal contact. In all riveted seams, fitting-up bolts are used in every other hole. All open holes are reamed, rivets driven, and then fitting-up bolts are removed and remainder of holes reamed and rivets driven. Courses are fitted together and circumferential seams are riveted before longitudinal seams. The fitting of courses together by shrinking is not used for the reason that the stresses set up by the shrinking are difficult to control.

(6) The ends of longitudinal seams are welded. All seams are caulked inside and out.

(7) The driving tonnage of rivets is controlled and recorded. Means are provided so that the pressure cannot be removed from the rivet until after a definite period of time. Swell-neck cone-head rivets driven with button sets are used to better fill the hole under the preformed rivet head. Rivets are heated in an oil furnace with a reducing or a neutral atmosphere. Caulking of rivet heads is not permitted.

(8) For the boiling out of oil and grease in new boilers, a compound containing tannin is used instead of caustic soda.

In the construction of articulated locomotives, these additional

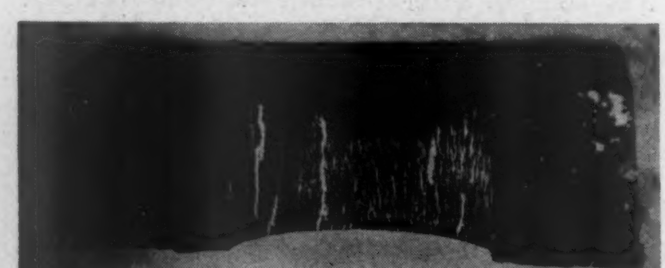


Fig. 6—Interior of rivet hole inspected by Zyglo and photographed while illuminated with ultra-violet light, showing the presence in surface of heat tears and tool marks, the failure resulting from fatigue cracks originating in these stress raisers

means are employed to prevent cracking of the boiler shells:

(1) All holes for connecting the cylinder saddle and liner to the boiler shell are drilled after the shell has been rolled into a cylinder.

(2) The size of the cylinder saddle and liner has been increased to provide a larger bearing surface between the saddle and the boiler.

(3) If the front boiler bearing saddle is attached to the boiler shell rather than to the smokebox, the attachment is made by use of the Cunningham strap. The size of the saddle has been increased to provide more bearing surface, and the liner between the saddle and the shell has been omitted in order to eliminate rivet holes in this area. A Fabreeka pad is used between the bottom of the saddle and the frame to absorb partly impact forces which are transmitted from the frame through the saddle to the boiler.

Cracking of Alloy Steels

The sub-committee studies of comments of suggested factors influencing the cracking in riveted seams and other places stressed that in an effort to obtain a more efficient and powerful locomotive, as well as a reduction in weight, many railroads started some years ago to build boilers with alloy steels. Such steels had higher tensile strengths, apparent good ductility and this appeared to be the answer for higher pressures and lighter weight. It is reported that most roads who have used such steel had had considerable and serious trouble with cracks in riveted joints. Suggestions were made that possibly residual elements were responsible, or that the chemical analysis was incorrect.

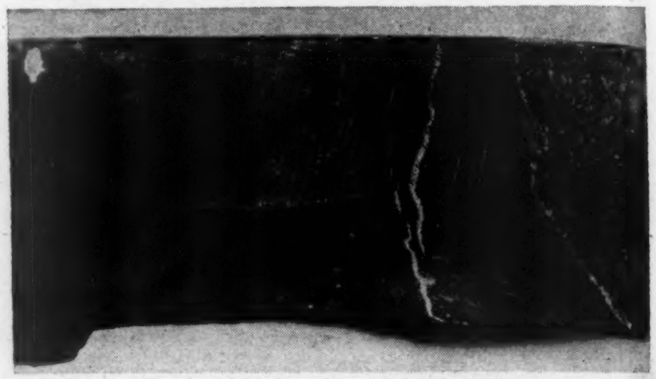


Fig. 7—Close up of interior of rivet hole, showing tool marks left by reamer—Fatigue cracks originated in these stress raisers and the failure was due to fatigue crack and blue-brittle fracture

In the early part of this report your attention was called to the fact that research studies are now being conducted as to the materials used in construction; also it was pointed out that the designers and material specifiers must recognize that conditions of temperature, loading, etc. react differently upon materials and that these conditions must be recognized in the development of suitable materials.

The fact that alloy steels have seemingly given poor service because of serious rapid failures is not the specific fault of the alloy as specified but that of the metallurgist, the designer and the manufacturer in not having the full data as to the effect of the factors of service operation in changing the inherent properties of the material. Thus alloy steels with apparent excellent ductility at room temperatures may at the operating temperature of the locomotive boiler, lose ductility through aging and becoming blue brittle and thus give a very rapid and qiuck brittle fracture. Such examples were explained in the outline of studies of failures.

Aging of Boiler Plate

Previously reported to you, has been that of the subject of aging of firebox and boiler steel. This means the phenomena which occurs under service conditions, recognizable by room temperature and elevated temperature physical tests where there is loss of elongation and increase in tensile and yield properties. The blue brittle phenomena occurs in the temperature range of from 400° F. to 700° F. Its effect in steels is that any force acting upon the steel in this temperature range has an injurious effect as the material is unable to distribute the stresses due to low ductility characteristics. The fractures resulting from this are usually of a sudden brittle nature, and have often been misinterpreted as that of the so-termed intergranular corrosion type.

While these materials may have higher tensile strength than at room temperature and greater resistance to a slowly applied load, it has much less resistance to suddenly applied loads and shocks as may occur because of design deficiencies under operation and from cool-down shocks.

Such studies have indicated that the steels as now specified for

locomotive boilers are, especially when used in a riveted type of construction, very sensitive to the presence of stress raisers, service loadings and stresses, temperature variations and tend to lose ductility through aging in service.

The research studies have not as yet developed steels which are fully satisfactory to meet the service required of the locomotive fireboxes and boilers. Certain trends have indicated fully killed steels are much less ssceptible than rimmed steels. The use of various de-oxidizing agents alone or in combination and of care in manufacture of the material seems to point to the fact that it will be possible that a satisfactory addition agent can be specified for both carbon and alloy steels. This will be reported upon when the research studies are completed.

Summary

The final consideration in this report is to again emphasize the complexity of the problem of cracking of riveted seam boiler shells. The use of an all welded construction, properly stress relieved, offers a solution to the problem through the elimination of stress-raisers and stresses occurring from fabrication practices.

Where riveted construction is to be utilized such stress-raisers as tool marks, sharp edges and fabrication stresses must be reduced to a minimum and eliminated if possible. Careful control of riveting temperatures to eliminate heat checks or tears must be had. Proper water conditioning to prevent the intergranular type of corrosion must be maintained. Design engineers must find means for the obtaining of and evaluating service loads and stresses especially at localized points of failure so that proper metallurgical considerations may be given to the material to be specified, or a reduction of these service stresses and shock loads must be obtained through design changes.

Materials for construction are the subject of research studies

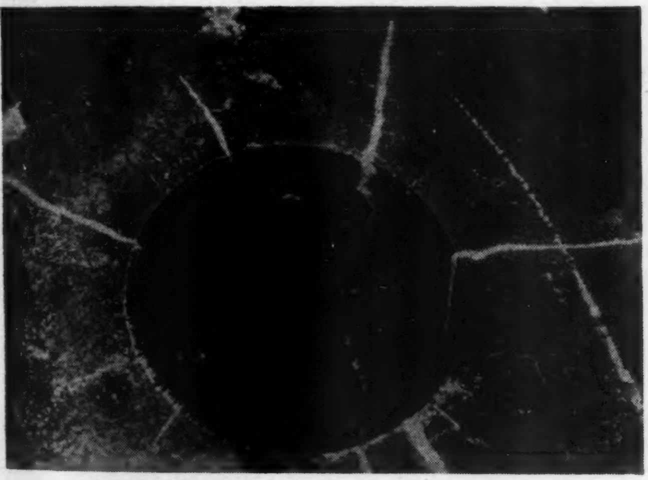


Fig. 8—Cracks originating at rim or edge of rivet hole, lap joint of second course—Note extreme sharp edge

and nothing definite can be reported at this time. Residuals in boiler and firebox steels are the subject of research and will be reported upon later.

The members of the committee are Ray McBrian (chairman), engineer of standards and research, Denver, Rio Grande & Western; J. P. Powers (vice-chairman), system boiler inspector, Chicago & North Western; H. H. Niemeyer, general boiler inspector, Chicago, Burlington & Quincy; H. R. Barclay, assistant general boiler inspector, Northern Pacific; R. C. Bardwell, superintendent of water supply, Chesapeake & Ohio; J. D. Johnson, chief boiler inspector, Missouri Pacific and W. Hedeman, engineer of tests, Baltimore & Ohio.

Discussion

Several members discussed the troubles that their railroads had experienced with alloy-steel boilers, most of which have been or are being replaced by carbon-steel boilers. One railroad is in the process of replacing 27 boilers by 24 all-welded boilers of carbon steel and three of riveted construction of the same material, the latter being built to prove that carbon-steel boilers of riveted construction will not crack. One member pointed out that his railroad has operated an alloy-steel boiler since 1930 without any difficulty but that 30 alloy-steel boilers built in 1938 have cracked.

There was general agreement throughout the discussion that the committee had done an excellent job in showing that the cracking of boilers is caused by several factors, a fact that has made it difficult for the boilermakers to determine the exact cause of individual failures.

Combustion Air for Fireboxes

(*Continued from page 639*)

ently due to more uniform air flow through the fuel bed. In road service the Undergrate Air Distributor gives a reduction in smoke well within local ordinance requirements, but smoking is not affected by the distributor one way or another in yard operations, making it necessary to exercise the usual care, at such times, with respect to firing.

The most recent attempt to improve locomotive performance through better air supply is found in the Norfolk & Western's experimental switcher.[3] This engine is equipped with mechanical draft and an automatically controlled stoker. The controls are arranged in such a manner that a proper fuel-air ratio is maintained at all load conditions. Under load, due to the air flow regulation, smoking is minimized. Such an arrangement reduces back pressure to the absolute minimum since free exhaust from the cylinders is permissible. The theoretical back pressure horsepower required to provide combustion air flow and gas removal in locomotives is shown in Fig. 5 and is an indication of the additional theoretical horsepower available for drawbar pull when the exhaust nozzle is removed. At the high sustained rates at which modern locomotives operate, it is obvious that the opportunities for improving performance through better means of drafting are very great.

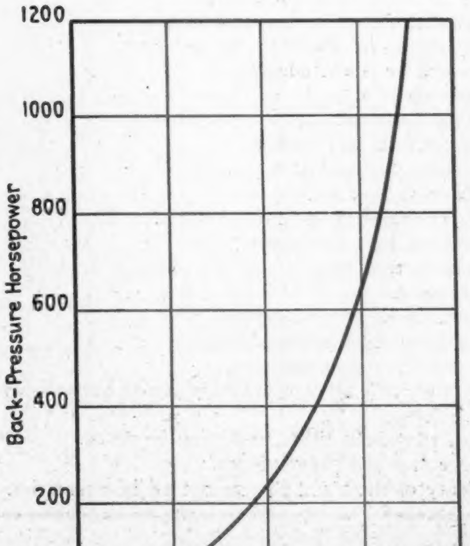


Fig. 5—Horsepower loss due to back pressure

[3] See article entitled "N. & W. Automatic Switcher", *Railway Mechanical Engineer*, August, 1947, page 402.

Safety—

The Supervisor's Responsibility*

Management, supervision and workers share the responsibility for safety but direct supervision has the greatest responsibility in building an interest in safety, in enforcing safe practices and maintaining safe conditions. Failure of supervision is the direct or indirect cause of many accidents.

The supervisor's responsibility to management is well understood. Management expects high productivity, steady work output, prevention of waste, low unit costs, etc., but cannot afford to overlook the need for safety, not only from the humanitarian standpoint, but from the dollars and cents viewpoint as well. The supervisor is responsible for efficient, economical and safe operation. It is just as much the duty of the supervisor to see that the work is done safely as it is to see that it is done efficiently. As a matter of fact, safety and efficiency are in most operations practically synonymous.

Management looks for high productivity, steady work output, prevention of waste and low unit costs but it cannot afford to overlook safety — That is a job for the supervisor

Responsibility to the Workers

Workers rely on the supervisor's knowledge to protect them against injury on the job. In the eyes of the workers, the supervisor represents the company because he is their principal point of contact; he is the front line of management. He is on the ground and can observe and check the development of bad work habits and unsafe conditions; he is the key to the safety program. It is he who introduces the new man to his job and sees that the new man is started off on the right path, properly instructed in safe working methods. The supervisor is ordinarily selected for his ability and for his knowledge of the work placed under his supervision, and it is essentially his duty to know at all times that the men under him are working safely and that their tools, machinery and equipment, as well as the premises, are as free from hazard as possible.

> *What Is a Supervisor?*
> (from Stunco, Taylor-Forge Club, Chicago)
>
> If he is pleasant, he is too familiar.
> If he is sober-faced, he is a sourpuss.
> If he is young, he doesn't know anything.
> If he is old, he is an old stiff.
> If he belongs to a lodge, the members expect favors.
> If he goes to church, he is a hypocrite.
> If he doesn't, he is a heathen.
> If he drinks, he is an old souse.
> If he doesn't, he is a tightwad.
> If he talks to everybody, he's a gossip.
> If he doesn't, he is stuck up.
> If he insists that the rules of the shop be kept, he is too particular.
> If he doesn't, he is too careless.
> If he looks around, he's snooping.
> If he doesn't, he's unobservant.
> If he tries to settle all complaints, he has to have the wisdom of Solomon.
> If he worries about them, he'll soon be crazy.
> Are there any good supervisors?
> Yes, plenty of them and they're not all in cemeteries.

How Can the Supervisor Fulfill These Obligations?

First, he must be able to think and act safely himself. He must set the example. No amount of preaching will do any good if the men see the supervisor ignoring the rules of safe practice. The wise plan is for him to avoid any personal act that would be objectionable if engaged in by the workers. The supervisor must be interested in and realize the importance of safety. His interest in it must never wane, and he must take his responsibilities for safety as seriously as he does the other duties of his position.

Second, he must make certain that the men under him maintain a continuous interest in safety. This means more than putting up an occasional safety poster or sign or passing out a book of safety rules and then expecting safety requirements to be fulfilled. He must follow an effective accident prevention program.

Third, he must strive to maintain and provide the workers with proper tools and equipment at all times. It is useless to expect men to observe safe practices at the same time one requires them to work with unsafe or improper tools or in unsafe surroundings.

Training Men to Work Safely

Some workers can learn from written instructions; others need to be told; there are some who cannot comprehend without being shown; and some others can only learn by doing. A good leader with a good personality can ordinarily accomplish best results by educating and instructing men by some or all of these methods, but at times he must resort to compulsion or discipline.

Men are hungry for good, understanding leadership, and a good leader who presents his subject matter in an intelligent and interesting manner can accomplish wonders in safety education.

To teach a man safe practices, a supervisor should first have a thorough knowledge of the work and of the hazards involved in it. He himself should have had a good deal of experience in the work, and should be well acquainted with the details of accidents that have occurred in his department. He should know the meaning of each safety rule, and he should be in a position to give sound reasons for each rule if questioned about it by the men.

However, merely knowing the work and the accident hazards is not enough; the supervisor must pass on his knowledge to the men and must instill in them a desire to follow the safe and efficient methods he suggests to them. Following the occurrence of accidents we often hear supervisors say, "I told him to be careful." But simply telling a man to be careful is not enough, for there is a big difference between telling and teaching; teaching goes beyond mere telling; it includes every avenue of approach to a man's mind to get the idea across. If the worker has not learned the supervisor has not aught.

A supervisor can often make a safe man of an unsafe one by talking with him to find out the reasons for his unsafe acts. The reasons may be in the shop or they may be in the man's home life; good counsel from the supervisor may be all that is needed to clear them up and to restore the worker's peace of mind so essential to alertness and safe work habits. However to be effective in counselling his men, the supervisor must have their confidence and respect; he cannot expect them to follow his advice on their personal problems or to be sold on his admonitions about safety practices unless they feel he knows what he is talking about and has their interests at heart.

Unusual or new job hazards and precautions against them should be discussed with the men as they arise. The super-

* From a Locomotive Maintenance Officers' Association report presented before a joint session of the Coordinated Mechanical Associations at Chicago on September 17, 1947.

visor must study each new or unfamiliar job to determine the safest and most efficient manner of performing it, and he must talk the matter over with the man doing the job to insure that the worker knows how to do it safely and must observe the worker's progress frequently enough to be sure that the job actually is being done efficiently and safely. Failing in this, the supervisor fails in his duty both to the man under his supervision and to the management to which he reports.

New men should command special attention. To make them efficient and safe workers, the supervisor must devote a good deal of his time to talking with them about their work and the best and safest methods of performing it, to discussing the rules with them, to demonstrating the effective and safe ways of performing their work, and to observing them to detect and immediately correct unsafe practices they may indulge in. Instruction in safety principles must be given repeatedly.

The supervisor should himself be on the watch for unsafe conditions and should give a ready ear to reports of them from others. After an unsafe condition is found, he should take prompt action to correct it.

Protective Clothing and Equipment

Supervisors should insist on workers conforming to rules against wearing loose clothing, rings, wrist watches, etc., when operating machinery and likewise should make certain that the men wear goggles, helmets, or other protective clothing and equipment when necessary.

Tools should be kept in proper condition; they should be inspected often and not allowed to go along without attention until someone is injured.

Defective tools should be repaired or discarded so that no one will have the opportunity of using them.

See that the men use the right tool for the job.

Supervisors who daily observe the use of unsafe or improper tools without taking prompt remedial action must expect accidents.

The supervisor should inspect machines and other equipment periodically to make sure they are in safe condition; he should give particular attention to guards, making certain they are in good condition and in use.

One can ordinarily make a good guess as to whether a shop or roundhouse has a high or low casualty rate by observing the housekeeping. Each shop or enginehouse should have a systematic clean-up program, and there should be a place for everything and everything in its place. A great many injuries result from slipping or tumbling as a result of material, debris, grease, tools, etc., being allowed to accumulate in the working areas.

Investigation of Accidents

When an accident occurs, it is the duty of the supervisor to make an immediate investigation to develop who or what caused the accident and how to avoid similar accidents in the future. It is likewise his duty to follow up his findings by taking effective action immediately to prevent a recurrence.

Summary and Conclusion

The supervisor is responsible for safety both to the management and to the workers. To fulfill his obligations, he must think and act safely himself, he must keep safety a live issue among his men, and he must strive to maintain safe working conditions at all times. He should try to inculcate safety by instruction but at times may have to resort to compulsion and discipline. He should be especially concerned about good housekeeping and the condition and use of tools and equipment, and he should investigate all accidents immediately and take such action as will prevent them in the future.

The supervisor is the key to safety in any plant; without safety-conscious supervisors, there would be no effective safety program. The supervisor is the overseer, the leader, the guide; if he performs these functions effectively, the men feel that he knows his business and realizes his responsibility, and a feeling of security and well-being will permeate the entire organization. The supervisor's spirit of service and responsibility is rewarded by the faith and confidence that his workers have in him, and they, in turn, are imbued with a spirit of service and responsibility to each other and to themselves.

The report was signed by W. H. Roberts (chairman), superintendent of safety, Chicago & North Western; G. S. Gandy, master mechanic, St. Louis Southwestern; A. H. Adang, superintendent of shops, New York, Chicago & St. Louis; W. W. Eshelman, supervisor of shop safety, Reading Company; W. B. Knox, district safety agent, Canadian Pacific; W. D. Nelson, assistant superintendent shops, Louisville & Nashville; and R. W. Schultz, supervisor of safety, Minneapolis, St. Paul & Sault Ste Marie.

Discussion

W. W. Eshelman discussed the use of protective clothing and said that even with the best of shop equipment and operating practices, protective equipment is required for certain classes of work. Goggles are the most important single item since the eyes are involved in about 12½ per cent of all accidents. Safety shoes are next in importance, foot and toe injuries amounting to 20 per cent of the total. Other special equipment required includes welders' protective shoulder pads, sleeves and leg guards, also asbestos mitts, sleeves and leggings for men engaged in babbitting and bearing metal work. Mr. Eshelman said that the effectiveness of this particular phase of safety work will depend entirely on the success of supervisors in training men to use this equipment in all cases where needed.

W. D. Nelson discussed the subject from the standpoint of unsafe and defective tools, pointing out the necessity for guards around all moving machinery parts, marked aisles and constant emphasis on increased safety. Mr. Nelson recommended holding daily safety meetings for each gang under the direction of its foreman and monthly meetings at which all safety leaders and general supervisors discuss progress and make plans for further improvement. He also stated that new men do not get as much instruction as they should and that the achievement of safety in shop operation is impossible without unrelenting care in handling all details presenting any possibility of accidents.

W. B. Knox talked about safety from the standpoint of good housekeeping and said that every reasonable effort must be exhausted to keep shops and enginehouses, locomotives and cars clean and orderly. An organization, he said, which accomplishes this result is bound to be safety minded. He also said that training programs must be extended to men in train service and to those in shops and enginehouses.

R. W. Schultz discussed the investigation of accidents and suggested the following procedure; namely, state causes, develop responsibility, take corrective action, and be especially careful who conducts the investigation. He also suggested avoiding common alibis and the need for more specific data. For example, who was careless and why. In fixing responsibility, the greatest care must be exercised to be absolutely impartial and keep in mind always the main objective, which is to prevent future accidents. Corrective action involves the determination of direct personal responsibility to remove the cause. The foreman is thus usually the best qualified to investigate in view of his intimate knowledge of working conditions and the personal limitations of the workmen involved.

* * *

Photo courtesy of R. H. Kindig

St. Louis-San Francisco's "Twin Meteor" near Jones, Okla.

EDITORIALS

Welding, A Railroad Protege

Much of the early development of fusion welding was carried on in railroad shops. In fact, it was railroad men who, during World War I, showed how to reclaim the sabotaged machinery on German ships which had been caught in this country at the outbreak of the war. From this beginning, the science of welding has progressed to a state in which there is now very little direct competition between the various processes—there are so many ramifications of welding and processes have been so combined that the basic requirements are those of developing new applications.

Six welding engineers, speaking at a recent meeting of the American Welding Society, outlined the more recent welding developments. The speaker for arc welding stated that electrodes have been so improved that there are as many a.c. welders being placed in service as there are d.c. In 1922, the ratio was ten to one in favor of d.c. Open-circuit, voltage-reducing devices have been a factor in this change, but the more important reason is better electrodes. D.c. machines are also being greatly improved. Another process which is serving effectively to improve electric welding is inert gas shielding. Welding is also being done successfully with many of the higher alloy electrodes.

Silver brazing, which was an ancient art, is now being used greatly to speed up production welding. The cost of the material used has been considerably reduced and quality of joints improved. The brazing of cast iron has been made easy by electrolytic cleaning.

The greatest advance in resistance welding has been the development of new machines. Standards are being set up so that the buyer will know exactly what he is getting. Also, a resistance welding manual has been published. Machine improvements include better and more convenient controls and improved means of handling parts to be welded. Stored-energy welders are being used for non-ferrous metals.

In the field of gas welding, means for distributing oxygen and gases have been greatly improved. In applications of inert gas shielded-arc welding, current values used have been increased many fold. This method permits welding without flux and is being used on heavy sections of aluminum.

Gas and arc cutting are being done in air and under water. Cutting machines are now available which will follow drawings automatically and will cut complicated forms accurately through one or many layers of metal. Electric cutting is being done with current values up to 1,000 amp. and applied in places where gas cannot penetrate. Arc-oxygen cutting is being used for cast iron and stainless steel. The gas torch with flux is also used for cutting stainless steel. For under-water cutting acetylene cannot be used at depths greater than ten feet, but the arc-oxygen torch can be used at any depth. It is stated also that there is no limit to the thickness of metal which can be cut by the arc-oxygen torch.

Other recent important advances include flame hardening, flame softening and descaling. Flame gouging has become highly important since it eliminates chipping and produces better quality steel in manufacture. Many advances have also been made with Thermit and pressure welding and within the last two years, power welding has found applications. In this process, the filler metal is blown into the weld in the form of a powder.

Some of the new processes do not have a railroad repair application, but nearly all of them are used in the making of products used by the railroads. It is gratifying to think that the railroads started something that is now so valuable to them and it is evident that they must constantly keep in touch with what is being done outside which can be given a railroad application.

Are Stoker Slides Justified?

Established locomotive practices come from two sources. In the majority of cases, a practice is established and retained because it serves a definite purpose, such as promoting economy, fulfilling an operating or maintenance requirement, or improving locomotive performance. A few practices, however, appear to result from reasons that are less sound. These few often have long custom and force of habit as the only basis for their present existence. Such practices are continued in use without their advantages being weighed against their disadvantages and the balance assessed.

An example of a long-established practice the continuance of which is open to question is the retention of stoker slides. Do the advantages of using a slide over the trough equal or outweigh the advantages of omitting the slide? Neither of what appear to be the two main advantages of stoker slides seems to be of much consequence. Roads which omit the slide do not experience the occurrence of difficulties which other lines may predict from the entrance of large foreign objects into the screw. And the safety feature seems overrated. While a stoker slide is a definite safety measure to a man who enters a partially filled tender

for the purpose of positioning the remaining coal so that it will enter the stoker screw, the slide is merely helping to correct a condition which it created. If there were no slide, and the trough were exposed to the coal supply throughout its entire length, the coal very likely would not have remained in pockets where it did not feed to the screw, and there probably would have been no need for a person to enter the tender in the first place. If it is not necessary for a man to enter the tender, he will not need protection from machinery within the tender.

The chief advantage to omitting the coal slide is, of course, the improvement in feeding the coal to the conveyor screw that will result from having a greatly increased portion of the coal supply directly above and in contact with the screw. When a slide is installed the trough opening is not only restricted but it is at a considerable distance from the coal in the front part of the tender. The coal, being a solid and not a liquid, flows only straight down, and that which is not directly over the opening will not enter the stoker screw. By removing the stoker slide, the fuel throughout the entire length of the tender is in close proximity to the conveyor screw. All but the small amount near the sides of the tender will drop by gravity into the trough for delivery to the fire.

Steel Shortage Limits Car Output

According to the American Railway Car Institute, a recent survey for a period of seven months of steel received by 19 plants building freight cars indicated the impossibility of car builders and railroad shops meeting the desired production goal of 10,000 new cars a month. The survey showed the exact tonnage of steel for new cars received monthly by car builders and their steel inventories at the end of each month.

Clear-cut charts giving results of the survey showed steel receipts by car builders for new domestic freight cars increasing from 52,000 tons in January, 1947, to 103,000 tons in June and then decreasing to 85,000 tons in July. These figures are to be compared with 158,000 tons needed for the construction of 8,500 cars a month in car builders' plants, plus 29,000 tons for 1,500 cars a month, built in railroad shops.

Total steel received by the car builders for freight-car construction showed relatively little variation during the first seven months of this year and reached a maximum of 119,000 tons in June, but July receipts were lower than those of January. Total steel deliveries to car builders, it should also be borne in mind, include steel required for new export cars, as well as steel used for maintenance, repairs and other purposes.

That car builders have not been "hoarding" steel for some ulterior purpose, as has occasionally been charged by uninformed sources, is shown by inventory records. The inventory of total steel on hand in all car builders' shops showed relatively little increase during 1947, ranging from 218,000 tons in January to 267,000 tons in June and dropping to 257,000 tons in July. These figures include steel for new export cars, and for car parts—M. R. O. By curtailing steel for the latter two purposes, the backlog of steel for new domestic freight cars has shown a gain, but is still only about 50 per cent of that required to assure steady operation of car builders' plants at a production rate of 8,500 cars a month.

Another difficulty which always occurs to some degree in car construction programs is to get steel in balanced car sets, avoiding the lack of certain small but critical items which can upset the entire program and schedule of deliveries. It is said that if current inventories were wholly in balanced car sets of steel, this metal would be run through assembly lines and exhausted in little more than five weeks at the desired production rate of 8,500 cars a month. Still another consideration is the time lag of about three months between the receipt of steel and delivery of finished cars.

In view of the facts cited, it is clear that incomplete supplies of steel were primarily responsible for failure to reach either the program of 7,000 cars a month set up for April, May and June, or the 10,000 cars a month desired beginning in July. It seems clear that some means must be found to allocate more steel to car builders and railroad shops if the nation's primary need for substantial numbers of additional new freight cars is to be met.

Balancing Parts For High Speeds

With the definite trend toward higher speeds in present day streamline passenger trains, the necessity for accurate balancing of rotating parts is of the utmost importance. This applies especially to equipment such as electric motors, generators, compressors and possibly even wheels.

Unbalance in rotating parts causes vibration which results in excessive wear and noise in the equipment, fatigue and nerve strain to those who use or operate it and damage to bearings and other parts.

The proper balancing of the rotating parts tends to eliminate vibration and thus makes possible the safe use of higher speeds and the building of equipment that operates more smoothly and quietly.

Unbalance in rotating bodies may be caused by unmachined portions in casting or forgings which cannot be maintained concentric with the axis of rotation due to the process by which they are formed; lack of homogeneity in all materials, whether cast, rolled, forged, formed, or otherwise processed; non-symmetry of a product brought about by limitations in design or requirements of fabrication; non-symmetrical distortion of a body while running at its operating speed; variations in the distribution of mass due to manufacturing tolerances as given to all machined surfaces. Actual lack of concentricity, squareness or parallelism of sur-

faces, due to cumulative errors in successive machining operations.

Considerable work has been done in the last two or three years, particularly, to see what can be accomplished in accurately counterbalancing Diesel locomotive and passenger-car wheels which operate at relatively high speeds. Balancing machines have been constructed with a capacity to take mounted wheels and develop accurate determinations of the amount of unbalance and where it is located. The difficulty has been in correcting the unbalanced condition since bolted connections or the welding on of additional material to any part of a car wheel is prohibited. No other methods yet tried seem to develop the necessary adhesive properties.

In connection with the balancing of wheels, perhaps one of the first steps which ought to be taken is to determine how accurate a static and dynamic balance is required from a practical standpoint. These wheels are usually turned practically all over, often ground on the treads and hence can hardly be out of balance more than a very few pounds at a maximum radius of about 20 in. A constructive purpose would unquestionably be served if tests could be made to determine whether or not an unbalance of this limited magnitude contributes appreciably to increased maintenance or hard riding.

Steam Locomotive Future

At the recent annual meeting of the Master Boiler Makers' Association at Chicago there was evident a considerable concern for the future of the steam locomotive —and that concern is of more than academic interest to boilermakers. There are too many boilers in operation now for the boilermakers to be worried about the possibility of losing entirely in the near future the opportunity to practice their art. However, the increasing mileage being made by Diesel-electric locomotives and the absence of new orders for new steam power does mean that there is less need for boilermakers now and that the trend continues to be unfavorable to their trade.

In speaking on modern steam locomotives at the meeting, C. C. Pond, assistant to general superintendent, Norfolk & Western, presented in concise terms the characteristics the steam locomotive must have to stay in the motive power picture. He said, "The future of the coal-burning reciprocating steam locomotive is dependent upon producing locomotives of high availability at a low initial cost that will have reliability of performance and low maintenance cost and that can be intensively utilized provided satisfactory fuel, coal, water, and better servicing facilities are furnished."

"These factors", Mr. Pond said, "do place some restrictions on the use of reciprocating steam locomotives, which are already burdened with the disadvantage of a low thermal efficiency. The N. & W. has been able to overcome these handicaps (except the inherent low thermal efficiency) and coal-burning steam locomotives are selected to handle our trains, not only because coal is an important part of the tonnage moved by our railway, but because of the low first cost, the low maintenance cost and the proven operating results." He mentioned the figures of the Bureau of Economics, Association of American Railroads, which show that throughout the war years and including 1946, the N. & W.'s figures for freight ton miles per train hour were the highest of any railroad 600 miles or more in length. Mr. Pond pointed out that this record was made under the handicaps of unusually heavy grades and severe curvature, neither of which is conducive to tonnage or speeds.

There are, of course, other considerations that will affect the choice of motive power in the future. One is the relative cost and availability of the different kinds of fuels, a factor which are dependent to a large extent upon the geographical locations of individual railroads. Another is the unpredictable influence of new motive power designs that have yet to be fully developed.

The Norfolk & Western has been a leader in the development of the reciprocating steam locomotive, but with the exception of its new experimental switching locomotive, the steam motive power of that road is not characterized by any startling innovations of design. Its locomotives are well proportioned. They incorporate features that have proved their worth in the attainment of first-class operating results, features such as bed frames, roller bearings and extensive lubrication. They receive high-class attention at up-to-date servicing facilities.

The future of the reciprocating steam locomotive will depend greatly upon the extent to which other railroads follow the examples set by the N. & W. and a few other railroads that have obtained outstanding operating performances with that type of motive power. In no other way can the steam locomotive hope to stay in the race with competitive types of power. There is no future for steam locomotives of obsolete design operating with the aid of antiquated facilities.

NEW BOOKS

Lessons In Arc Welding, Third Edition—*Published by the Lincoln Electric Company, Cleveland 1, Ohio. 158 pages, 5-½ by 8-¾ in. Illustrated. Price 50 cents in U. S. A., 75 cents elsewhere.*

The object of this book is to present in a concise manner some of the fundamental facts of welding so as to enable the welder to use the welding process successfully and economically. The series of lessons included in the book forms the basis of the instruction in the Lincoln Arc Welding School. It includes the lessons given in both the basic and advanced courses at the school. The basic course is devoted entirely to the welding of mild steel and the advanced courses comprise the welding of alloys, sheet metal and pipe. A feature of the book is the simple and informative illustrations that accompany each lesson.

With the Car Foremen and Inspectors

Maintenance of

Passenger-Car Trucks*

Report on detailed truck repair practices necessary for satisfactory high-speed operation

It is not the intention of the committee to submit a report for truck design or the technical aspects of a passenger car truck. The committee has confined its report to the maintenance that we feel should be given to whatever design of truck is used to keep it operating at peak efficiency.

Many railroads have operated high speed trains for a number of years and others have placed orders for their first high speed trains, but to continue to obtain the easy riding and comfort that these trains afford the first few weeks of their operation, a high degree of truck maintenance is necessary. Railroad managements have come to expect more of the trucks under these trains than to keep the car body off the rails. They have to do more than just reach the terminal without causing a wreck or delay; they must also give a great deal of comfort on the trip.

V. L. Green, Chairman

Wheels

The most important item on a passenger car truck is the wheels. There isn't any truck design today that will produce a good ride at high speed with bad wheels. The wheel mileage on high speed trains is greatly reduced over general service trains for two reasons. First, the small amount of wear that can be permitted and still obtain a good ride at high speeds. Second, the accelerated wear on the tread and flange from the greater abrasion from the rail and heavier brake applications. Any railroad that is getting in excess of 40,000 miles at high speeds between dressings is fortunate.

Wheel treads, when applied to the car, should not exceed the following eccentricities: 90 m.p.h. to 100 m.p.h. not to exceed .010 in.; 80 m.p.h. to 90 m.p.h. not to exceed .015 in.; below 80 m.p.h. not to exceed .025 in.

It is nearly impossible to obtain wheels within these limits without grinding. If wheels are applied within these limits, they will not exceed them by more than 100 per cent when the wheel is removed after 30,000 to 50,000 miles.

It is possible to grind the wheels from two to three times before wheel turning is necessary on account of high flanges. Considerable economy on total wheel life can be accomplished in this way.

The eccentricity of the wheel should be checked from its bearing, as shown in Fig. 1, and not when it is mounted in the wheel lathe or wheel grinder. Axle centers must also be well maintained to get wheels within these limits.

While there are many other parts of a truck that can cause car shimmy which will be discussed later, wheel wear is the greatest offender. The only way that wheel shimmy can be cured is by redressing the wheel tread.

As to the shape of the tread contour this committee feels that C. T. Ripley, formerly chief engineer, Technical Board, Wrought Steel Wheel Industry has dealt with this matter more thoroughly in his several appearances before this group than we could in this report. We would like to say that whatever contour is selected, it must be maintained and metal not allowed to pile up on the outside of the tread or critically shaped shoulders develop next

Fig. 1—Wheel eccentricity being checked from the journal-box bearing

* Abstract of report of Committee on Passenger-Car Truck Maintenance presented at the meeting of the Car Department Officers' Association held at Chicago September 15 to 18, 1947.

Fig. 2—Checking car axle for cracks with Magnaflux equipment

to the throat of the flange. Either one of these will develop car shimmy and hard riding regardless of the contour when new.

Wheel balance is being suggested for wheels on high speed trains. Some railroads and car builders have turned the wheels overall and balanced the wheels. Some of the wheels were found as much as 10 lb. out of balance before turning and 3 lb. after turning. These wheels were balanced by grinding on the inside edge of the rim. The committee has not been able to obtain any reports on the performance of these wheels.

We understand that the A. A. R. Wheel Committee has worked up a program of tests to evaluate riding qualities with wheels in various conditions including dynamic balance.

More and more railroads are finding it advisable to apply anti-wheel sliders to their high speed cars equipped with 250 per cent braking. Regardless of the type used they must be checked at frequent intervals and closely maintained. The committee recommends that they be checked before every trip. Air brake cleaning periods appear to be often enough for dismounting through inspection and repair.

When changing wheels care should be taken to apply wheels having approximately the same rim thickness to prevent tipping of truck frame. When proper size of wheels are not available the truck frame should be leveled at the equalizer springs.

Pedestals, Liners and Bearings

Next to wheels the second greatest offender in hard riding and accelerated wear on a passenger car truck is the pedestal and bearing liners. Badly worn liners do not only contribute to bad riding, but greatly accelerates the wear on the equalizers, truck frames and equalizer seats on the bearing housings.

When the longitudinal clearance in the pedestal exceeds $\frac{1}{8}$ in. in high speed trucks and $\frac{3}{16}$ in. in moderate speed trucks the liners should be renewed. On trucks employing wing type boxes the clearance must not exceed $\frac{1}{32}$ in. or galloping and slapping will result. Liners should be welded to the pedestals and bearing housings. Extreme care must be exercised to insure that the liners are tight against the pedestals. High spots on the pedestal should be removed so that the liner has a solid backing. Unless this is done no weld will hold. In many cases it is necessary to apply thin shims between liner and jaw to provide a solid backing for liner. A jack should be inserted in the pedestal gap to force the liners against pedestal jaws. Good results can be obtained by using three-piece liners instead of the standard channel shaped liners. It is easier to insure tight fits against the sides of the pedestal jaws although it requires more welding to secure them. The welding rod companies have developed, in recent years, a new ferritic rod which makes a satisfactory weld between the spring steel liner and the pedestal. Good results can be obtained with either spring steel or abrasion resisting steel.

The ferritic welding rod has greatly reduced the objection to the spring steel liners breaking away from the welds. Excessive lateral clearance is especially destructive on high speed cars. This lateral clearance should be remedied before the clearance reaches $\frac{3}{8}$ in. by renewing the pedestal or bearing housing liners or both. The excessive journal box clearance due to worn liners can be the cause of car shimmy.

Pedestal conditions should receive very close inspection at the time of schedule truck repair. If passenger cars are given schedule repairs not to exceed 18 months, pedestal liners should run this length of time.

Any indication of wear or chafing on the side of the equalizer is a certain indication of excessive lateral clearance between journal box and truck frame. It requires a thorough inspection to determine the proper place to shim and make liner repairs to remedy this trouble.

Badly tipped boxes even on moderate speed trucks should be renewed to prevent boxes from wearing a shoulder on liners and sticking in the pedestals. This causes a very unsatisfactory riding car even in the lowest speed truck.

Passenger Car Axles

Passenger car axles are the back bone of truck safety. There is no item upon which so much depends as on the axle. Extreme care must be taken in their handling, machining, mounting and inspection. The safety of an entire train can be impaired by a hair crack or nick that goes undetected. Passenger car axles should be magnafluxed over-all every time the wheels are stripped. While the magnaflux is not infalliable it will indicate many cracks that would not have been found by visual inspection. See Figs. 2 and 3.

Most railroads do not set an age or mileage limit on axle, but depend on the magnaflux and visual inspection and size to remove bad axles from service.

Ninety-nine out of a hundred axle failures are caused by either poor design, workmanship, handling, material or corrosion and not fatigue alone.

Close inspection and maintenance is required to keep pedestal tie straps tight. Loose tie straps are very hazardous to both the train and passengers standing on the boarding platforms. There have been a great many different kinds of lock nuts, spring washers, retaining clips and lugs and other devices tried through the years with respectable success.

Bolster coil springs in most of the modern high speed trains have a short life. One to three years appears to be all that can be obtained until they have taken a set. Reclaiming of these springs has been very unsuccessful and should not be done. A high speed truck should never be shimmed in the equalizer spring to level the car for set that has taken place in the bolster springs. This throws the spring plank out of level and the swing hangers

Fig. 3—Type of wear pad which is welded to the equalizer end

move to one side and will not operate in this central position. It is very tempting to do this because of the difficulty of removing and applying the bolster springs. But the heart of a good ride is the proper leveling of the car by means of the bolster coil spring. Cars that have uneven cross weights, such as room cars or diners, require careful shimming.

Snow and ice must be removed from the bolster springs, both coil and elliptic if the good riding is to be maintained. This is, on northern railroads, quite a problem at times, but it must be done.

Some railroads have tried several designs of covers and boots. None enjoyed any success that the committee knows about.

Foundation Brake Rigging

Worn brake rigging is one of the biggest contributing factors to a noisy car. When the brakes are on worn brake hanger pins and hanger bushing will produce brake chattering and become very annoying to the passengers.

Brake pins that are retained by cotter keys will give better life than those retained by nuts because the pin can rotate and present all the surfaces of the pin for a wearing surface. The cotter should be used with a flange washer.

Brake cotter keys should be tight in the pins. A passenger

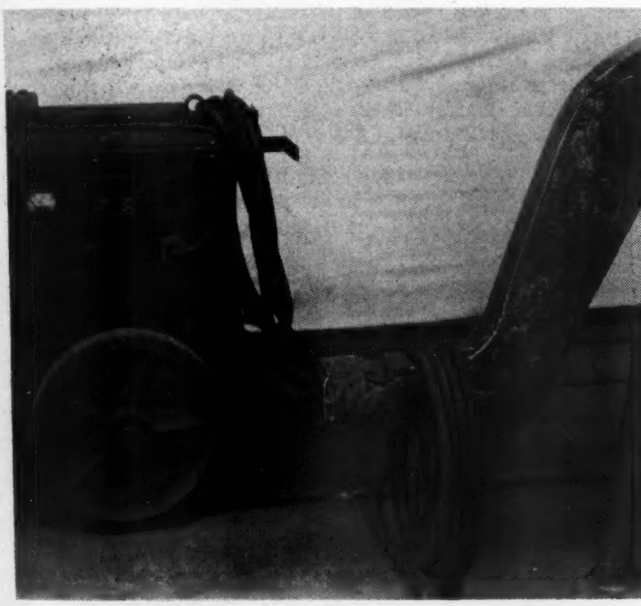


Fig. 4—Equalizer ends are Magnafluxed at each general overhaul

car brake rigging is spring borne, and this is not so important as in an unsprung rigging on a freight car, but derailment and delays are caused by down brake rigging in a passenger car.

Pins and bushings in the pull rods do not wear as rapidly as the brake hangers, but they should be renewed when worn 1/16 in. or more because they do contribute to the noise level and add false travel which is a problem in a 250 per cent brake rigging.

Brake keys must be bent or wired in place on high speed equipment to prevent their accidently coming out.

Manual slack adjusters must be inspected and repaired at overhaul period or they will unscrew when the brake is released until piston travel has exceeded the cylinder capacity. Balance hangers improperly maintained will cause excessive wear in the brake hangers, heads and brake shoes. These hangers should receive the same attention as the rest of the brake rigging. Loose balance hanger brackets also contribute to truck frame breakage because of the holes wearing excessively.

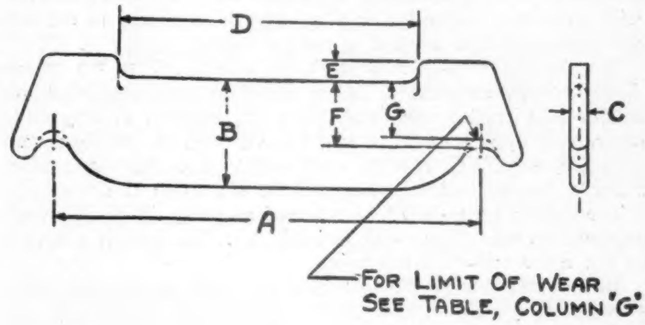
The best way to keep down equalizer repairs is to keep the truck in proper adjustment so that the truck frame will not wear grooves and cut notches in the equalizers. Worn equalizers are a sure indication of improper truck maintenance.

Equalizers should have pads applied on the feet and they should be renewed at every overhaul period. These pads should be welded to the equalizer from the center of the retaining notch on one side and around the back to the center of the notch on the other side. See Fig. 3.

The under side of the hook of the equalizer should be ground and magnafluxed at every overhaul period of 24 to 30 months. See Fig. 4.

The equalizers should also be removed for inspection after any wreck or derailment regardless of how minor.

If wear pads are applied to equalizers and the truck kept in



G Limit of wear, in. Final limit	G Limit of wear, in. At truck shoppings,	F In.	E In.	D In.	C In.	B In.	A In.
1½	1⅝	2⅛	1¼	12	¾	4¾	19⅞
2⅝	2¾	3¼	1¼	19½	1	5¾	23⅜
2⅜	2½	3	1⅛	18	1	5	25⅝
3⅛	3¼	3¼	1⅛	18	1	5¾	25⅝
3⅛	3¼	3¾	1⅛	18	1	6¼	25⅝
3⅛	3¼	3¾	1⅛	18	1⅛	6	25⅝
3⅛	3¼	3¾	1⅛	18	1¼	6¼	25⅝*
3⅛	3¼	3¾	1⅛	18	1¼	6¼	25⅝*
3⅛	3¼	3¾	1¼	18	1¼	6¼	25⅝†
1½	1⅝	2⅛	1¼	12	1	4¾	26
3⅞	4	4½	1⅛	21½	⅞	5⅞	26½
3⅞	4	4½	1⅛	21½	1⅛	6	26½
3	3⅛	3⅝	1¼	19½	1¼	6¼	26½
3⅞	4	4½	¾	23¾	1¾	6½	27¼
3⅞	4	4½	⅝	21½	1⅛	6	30
3⅞	4	4½	⅝	21½	1½	6¼	30

* Swing hanger crossbar is identical on Budd drawings 99-2217 and 99-1217 which appears tabulated on 99-0617, Lines 2 and 3.

† For repairs swing hanger crossbar drawing 99-1717 to be superseded by crossbar drawing No. 99-2217.

Fig. 5—Limit of wear on truck swing-hanger crossbars

adjustment there is very little reason for any welding or restoration work on an equalizer. If an equalizer is rubbing a truck frame hard enough to harm it the truck is also riding very badly.

Swing Hangers and Swing Hanger Axles

Swing hangers should be very closely inspected at each shopping of the car. They should be magnafluxed and ground in all critical areas such as the bend in one piece hangers. Swing hanger and related parts should run between schedule overhaul. All swing hangers and related parts should not be built up by welding because of the danger of covering up cracks that will later spread under the welding and lead to failure. These built-up sections are seldom any stronger after welding than before even if they do not hide small cracks.

Some railroads provide the truck shop foreman with a chart for the scrapping of swing hangers and swing hanger axles. Figs. 5 and 6 are typical examples of such a tabulation used by a middle western railroad.

Swing hanger axle friction surfaces should be redressed by grinding to remove all built-up metal and eroded surfaces. The axle bearing surfaces should also be ground to remove all built-up metal and eroded surfaces.

Swing hanger pins and bushings should be renewed at overhaul periods if the wear exceeds 1/16 in. because by the time the car is in for the next schedule overhaul the pins and bushings will have worn through the case hardening and much more expensive repair will be necessary even making it necessary to repair the swing hanger.

Hydraulic shock absorbers should be changed each year. Some railroads that have trains that build up high mileage repair the snubber every six months. After the shock absorbers start leaking it is a very short time until the instrument fluid is exhausted and of no further value.

If any railroad intends to repair their own shock absorber a

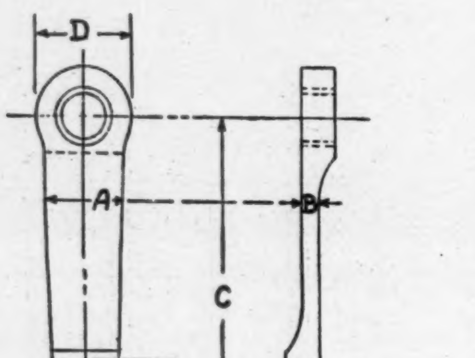
test machine is absolutely necessary. These shock absorbers wreck themselves in a very short time if they are allowed to operate without fluid.

The rubber bushing attachment of all hydraulic shock absorbers must be maintained in excellent condition if the full value of the instrument is to be obtained. Hydraulic shock absorbers operated with worn out rubber bushings produce high shocks in the cars and offer very little control to the car body.

The bolster anchor rods must be maintained at the proper distance between centers. Care must be exercised that the bolster positioned by the rods clear the transom or any other obstruction by at least 3/8 in. and preferably 1/2 in. If the anchor rods are allowed to operate with rubber pads that have taken a set, a longitudinal vibration will be set up in the car body.

The rubber pads should be renewed at every 18 to 24 month overhaul period. They will probably last this long if the cars do not make excessive mileages.

Anchor rods should be inspected for tightness at least once



H Limit of wear, in. Final limit	At truck shoppings	New	G In.	F In.	E In.	D In.	C In.	B In.	A In.
1 1/8	1 1/4	1 3/8	6 3/4	1 1/8	2 3/4	3 1/2	20 1/4	1 1/2 dia.	..
1 1/8	1 1/4	1 3/8	6 3/4	7/8	2 1/2	3 1/2	18 9/16	3/4	2 1/4
1 1/4	1 3/8	1 5/8	6 3/4	1 1/8	2 3/4	4 1/2	18 13/16	1	2
1 1/4	1 3/8	1 5/8	6 3/4	1 1/8	2 1/2	4 1/2	19 5/8	1	2 1/2
1	1 1/8	1 3/8	7 1/2	1 1/4	2 3/4	4 1/2	23 1/16	1	2 3/4
1	1 1/8	1 3/8	7 1/2	1	2 3/4	4 1/2	23 3/16	1	2 3/4
1 1/4	1 3/8	1 5/8	6 3/4	1 1/8	3	4 1/2	19 3/4	1	3
1 1/4	1 3/8	1 5/8	6 3/4	1 3/8	3	5	19 3/4	1	3
1	1 1/8	1 3/8	7 1/2	1 1/4	3	4 1/2	23 1/16	1	3
1 1/4	1 3/8	1 5/8	6 3/4	1 3/8	3 1/2	5	19 3/4	1	3 1/2
1 1/8	1 3/8	1 5/8	7 1/2	1 3/8	3 1/2	5 1/4	22 7/8	1	3 1/2
1 1/4	1 3/8	1 5/8	7 1/2	1 1/4	3 1/2	5	23 1/16	1	3 1/2
1 1/4	1 3/8	1 5/8	7 1/2	1 3/8	3 3/4	5 1/4	22 7/8	1	3 3/4
1 1/4	1 3/8	1 5/8	6 3/4	1 3/8	3 3/4	5 1/4	19 1/2	1	4
1 1/4	1 3/8	1 5/8	6 3/4	1 3/8	3 1/2	5	19 3/4	1	4
1 1/4	1 3/8	1 5/8	6 3/4	1 3/8	3 3/4	5 3/4	19 1/2	1	4
1 1/4	1 3/8	1 5/8	6 3/4	1 3/8	3 3/4	5 3/4	20 3/4	1	4 1/2
1 1/4	1 3/8	1 5/8	7 3/4	1 1/2	3 1/2	5 3/4	21 1/2	1	4 3/4
1 1/4	1 5/8	2 1/4	6 3/4	2	4 1/2	6	21 1/2	1 1/4	3 1/2

Fig. 6—Limit of wear on truck swing hangers

a week. A thorough inspection of the tie rod and small bushing should be made every four months. If the anchor rods are allowed to operate loose the threads on the tie bar are soon destroyed as well as the small bushing.

General Inspection and Adjustment

The cost of truck repair at overhaul periods can be greatly reduced if proper inspection and adjustments are made in the coach yards.

The riding of the truck is dependent on these inspections and adjustments as much as the truck design as no truck, whatever its design may be, will not ride properly if it is allowed to run improperly adjusted.

The cars must be kept level at all times because an unlevel car will roll and have excessive lateral thrust if out of level.

Rigid side bearing clearance should not be allowed to exceed 3/32 in. total. If a flexible side bearing is used, such as spring or rubber, the side bearing should be set with "O" or clearance with a slight compression.

The oil level in the anti-friction bearings should be checked at regular intervals. Each manufacturer of anti-friction bearings has a different check period.

Stench and smoke bombs, if used, should have a representative sample tested at least once a year.

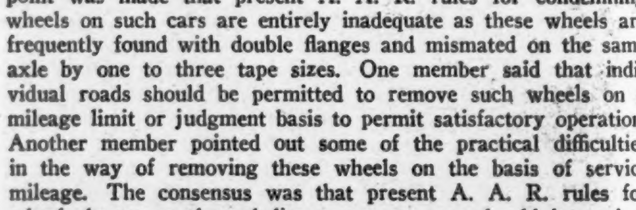
The report was submitted by V. L. Green, chairman, assistant mechanical engineer, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; N. T. Olson, principal mechanical engineer, Chicago & North Western, Chicago; J. A. Schroeder, engineer car maintenance, Union Pacific, Omaha, Neb.; G. J. Flanagan, chief car inspector, New York Central, New York; H. J. Oliver, assistant superintendent motive power, Detroit, Toledo & Ironton, Dearborn, Mich.; O. H. Clark, assistant superintendent car department, Missouri Pacific, St. Louis, Mo.; E. S. Swift, chief car inspector, Wabash, Decatur, Ill.; J. R. Matthews, assistant mechanical superintendent, Pullman Company, Chicago.

Discussion

This report was highly commended and much of the discussion centered around wheel conditions on streamline passenger cars which are interchanged or pass over two or more railroads in proceeding from the original to the final terminals. The point was made that present A. A. R. rules for condemning wheels on such cars are entirely inadequate as these wheels are frequently found with double flanges and mismated on the same axle by one to three tape sizes. One member said that individual roads should be permitted to remove such wheels on a mileage limit or judgment basis to permit satisfactory operation. Another member pointed out some of the practical difficulties in the way of removing these wheels on the basis of service mileage. The consensus was that present A. A. R. rules for wheel change on through-line passenger cars should be revised in the light of the conditions mentioned.

(*The report was accepted.*)

* * *



Engineman on a Pere Marquette streamliner confers with a fixed station at Grand Rapids, Mich.—Two passenger trains are equipped with train radio systems permitting them to talk with each other and with the fixed station—The radio telephone is also being tried for switching service

Car Shop Automotive Equipment*

Additional data supplementing the extensive and comprehensive report on this subject presented at the 1946 meeting

Your committee proposes to show, through the use of pictures and brief description, many of the newer types of automotive equipment which have proved adaptable to car department use.

C. C. Cowden,
Chairman

However, before proceeding with that part of the report, we feel that a brief review of some of the items covered in the report to the 1946 convention is in order.

You will recall that, in connection with automotive equipment for use in train yard and on the light repair tracks, the following types of equipment were recommended: Three-wheel, pneumatic-tired, delivery truck with low flat deck; small lightweight tractor with pneumatic tires; swing boom tractor crane with telescopic boom.

* From the report of the Committee on Car Department Automotive Equipment presented at the meeting of the Car Department Officers' Association held at Chicago September 15 to 18, 1947.

Power truck handling side frame with chain connection from swiveling wheel carrier

Another type of lift truck stacking pallets loaded with brake shoes

Our study indicates that the three types of equipment mentioned above are still the most practical for general use; however, we are told that in many shops where the size of the operation warrants, lift trucks of various types are proving useful. Many of the pictures which will be shown later will demonstrate various uses to which lift trucks can be put and we feel that some type of lift truck should be added to the above list.

In another phase of the 1946 report, the subject of automotive equipment for use in repairing cars set out between terminals was covered at some length. Four types of equipment, which were in most common use were discussed, including: One-half-ton pick-up truck, with cab; one-ton stake body, with benches on deck for seating passengers; station wagon equipped with heavy-duty springs in rear; jeep with 4-wheel drive and small stake body.

In addition to the above, considerable time was given to the discussion of a truck chassis with cranes mounted on the bed, power being furnished by the motor. The cranes are used for loading wheels and other equipment at the shop and unloading at the car after arrival, as well as handling truck sides and bolsters during the wheel changing operation. We are informed that the use of this type of truck for making repairs to cars set out between terminals has increased and that satisfactory results are being obtained.

It has come to our attention that, in addition to the above, some roads are now experimenting with a truck similar to that mentioned above, but in place of the crane being mounted on the rear deck, the truck is equipped with an hydraulic-lift tail gate.

On the basis of reports received, we feel that a brief description of this equipment is warranted.

In lowered position, the tail gate rests flat on the ground, the loading surface being approximately 4 in. above the ground level, which facilitates loading. After loading, the gate raises vertically to the level of the truck bed so the load can be slid or rolled directly onto the bed. The gate then is raised into normal position of closed tail gate, protecting the load.

The rated lifting capacity of the gate is 3000 lb., which makes it possible to load mounted wheels, truck bolsters, truck sides,

jacks, blocking, etc., with a minimum of effort and without tying up shop cranes and other equipment.

Upon arrival at the car to be repaired, the rear of the truck can be backed into the desired position and material unloaded quickly and easily.

It also seems probable that a truck of this type could be used to transport men, blocks, jacks, etc., to minor derailments, and in many cases forestall calling of relief train and full crews. This would be especially true of yard derailments where engine and crew are often tied up for hours because of having to haul a block car containing blocking, tools and other equipment to the point of derailment.

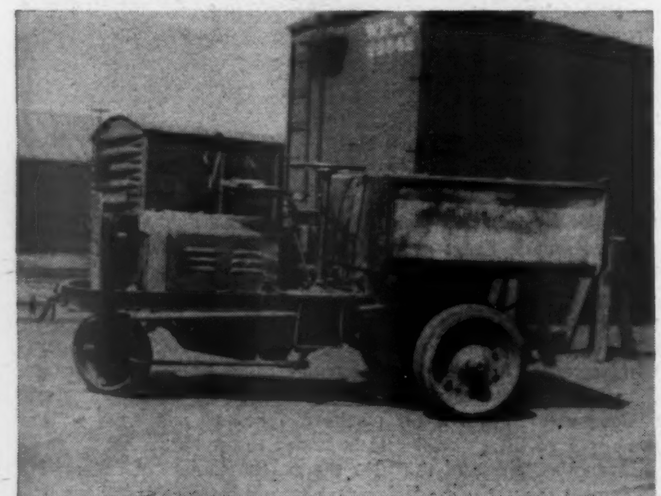
Also, at major derailments, because of the ease with which a car truck can be loaded and unloaded, we believe that a truck of this type could be used for hauling ties, pulling light wreckage out of the way and many other jobs which would expedite the clearing of the main track.

We feel certain that trucks equipped with hydraulic-lift tail gates will prove to be popular in the near future, as more and varied uses for it are being discovered daily.

In connection with automotive equipment for use in heavy repair shops, we have no specific recommendations to add to our previous report, but hope that you will be able to get some constructive ideas from the pictures which will be shown at this time.

(The committee here presented 23 lantern slides illustrating various types of automotive equipment successfully used in car repair operations.—Editor.)

That concludes the showing of the pictures and in closing



Small dump truck effectively used in cleaning cars of scrap, refuse, etc.

may we again recommend that at points where the size of the operation warrants, a central garage for daily servicing and repairs of automotive equipment be established, to be used jointly by all departments; also, that concrete roadways be provided wherever possible, in order to get the maximum performance from automotive equipment.

(The report was signed by C. C. Cowden (chairman), assistant superintendent car department, New York, Chicago & St. Louis, Cleveland, Ohio; J. G. Rayburn, superintendent car repair shop, Chesapeake & Ohio, Russell, Ky.; A. C. Schroeder, assistant superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; G. D. Minter, division car inspector, Norfolk & Western, Portsmouth, Ohio; H. H. Young, superintendent car department, Illinois Central, Chicago; V. Small, assistant general master car builder, Elgin, Joliet & Eastern, Joliet, Ill.)

Discussion

Considerable interest was displayed in the end-gate lift truck and one member asked if it could be used to pull cars in cases of derailment. The chairman replied that this would not be possible with lighter trucks, but that heavier trucks of this type can be used to rerail empty cars at considerable distances from terminals.

A question was raised regarding the cost of concrete runways, one member from New Orleans, La., stating that rolled shell or gravel runways are producing good results and another that promising experiments are being conducted with four inches of decomposed granite on top of a cinder base, when properly rolled. Another suggestion was the use of two inches of chat on a gravel base. The consensus was, however, that all runways of this type require considerable maintenance expense in order to keep the surfaces smooth and level and that concrete runways will pay a substantial return on the investment at all major car repair points.

(*The report was accepted.*)

Railway Paint Needs Are Urgent

By Grover M. Hermann*

Ignored by most travelers, but revered by railroad hobbyists, exotic and fanciful Pullman car names will be big business for paint manufacturers during 1947. Even the insignificant numbers and names on chair cars, coaches, diners, and sleepers will represent a $70,000 expenditure in a projected $100,000,000 painting program of 737 domestic railroads. These railroads will use 14,000,000 gal. of exterior and interior paints on rolling stock and buildings.

Ten years of depression economies and five years of war-time operations have combined to make much rolling stock obsolete. Unless the remaining equipment and all buildings are repainted soon, further obsolescence and curtailment of service is inevitable. The paint industry must double its best pre-war output to meet current demands for $32,000,000 worth of railroad finishes.

Of this amount, paint for freight and gondola cars cars will require the largest single expenditure, taking $25,000,000 worth of material. Buildings, which range from small switch shanties to mammoth metropolitan terminals, will take interior and exterior finishes valued at $5,550,000. Paint for locomotives and passenger cars will cost the railroads more than $3,000,000 and miscellaneous structures, including signs, signals, water stations, and bridges will consume a variety of finishes worth $600,000 in the aggregate.

Materials represent only 35 per cent of a railroad's painting bill. Unprecedented gallonage, higher raw material costs, and increased labor costs, will largely explain the railroads' big painting bill this year.

Where all railroad demands were satisfied with paints worth $16,000,000 in 1940, refurnishing of 892,231 freight cars at $27 each this year will take $24,090,318 worth of paint, mostly brown-red. Refinishing of passenger cars will cost $60 on the average, with the paint bill for 25,850 cars totalling $1,575,232. If 5 gal. of paint are applied to each of the 370,000 railroad buildings, total expenditure will exceed $5,000,000. And paints for roadway signs will cost $275,000 at present prices.

Present Paint Trends

In earlier days, railroads used paints for protection, not decoration, so we concentrated on black finishes for locomotives, green for passenger cars, and red-brown finishes for freight cars. Although these colors are still listed as "standard," Class I railroads run the gamut in color specifications today.

Orange has found wide acceptance on high-speed trains because of its visibility. Yellow has become tradi-

* President of the American-Marietta Company, Chicago.

tional for refrigerator cars because it shouts for "special handling" in the freight yards. Aluminum paint has won wide favor on bridges, poles and other structures. The railroads have become so color conscious that crack passenger trains are now designated by such names as "The Green Diamond," "The Royal Blue," "The Silver Meteor" and "The Redbird."

Although railroad paint consumption this year will far exceed previous sales records, equipment serving 280,000 miles of right-of-way in the United States and Canada always takes a large amount of special finishes.

Locomotive front ends are refinished frequently due to extreme boiler temperatures. A bridge near the coast needs painting every 3 years while similar structures in desert areas need attention every 10 years. Depots and other buildings must be given one-coat of exterior and interior treatment every 4 years. Box cars can go 8 years without repainting but gondola cars, subject to damage by sledges when frozen coal is unloaded, need paint every 5 years. Ideally, passenger cars are repainted every year when sales appeal is a factor while secondary or commuter trains can operate for several years before cinder abrasion and locomotive gases take their toll in paint deterioration. Locomotive cabs, tenders, and trucks are repainted every time a major shop overhaul is scheduled.

Paint prices have risen sharply in specialized transportation finishes due to substantially higher raw material costs. As an instance, before the war linseed oil could be purchased at a price of approximately 75 cents a gallon whereas today it costs approximately $2.95 a gal. Practically every other oil used in paint manufacture has advanced in approximately the same proportions. Glycerine which could be bought for 11 or 12 cents a pound before the war now costs from 55 to 65 cents a pound. Lesser advances have taken place in practically every paint manufacturing raw material which, of course, must be reflected in increased selling prices for paints. To offset some of these advances in costs, and scarcities of raw materials, the paint industry has made remarkable progress in developing and utilizing many chemicals which were previously unknown to the paint industry. This has enabled them to supply more paint and, in many instances, vastly superior products which tend to offset ultimate painting costs.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Railroad Possessing Car Responsible for Fire Damage

A Great Northern baggage car loaded with Government property, consisting mainly of sea bags and bed rolls, was discovered on fire near Brundidge, Ala., while being moved in an Atlantic Coast Line train on January 31, 1944. The fire was extinguished at that point and moved to Montgomery, Ala., where the contents were removed in the presence of military authorities and the car inspected. The damage to the car was estimated at $225.00 and being found safe for service it was reloaded with the original contents for shipment to its destination, Camp Pendleton, California. The car was moved via the Louisville & Nashville and the Louisiana and Arkansas and delivered to the Texas & Pacific at Shreveport, La., on February 6, 1944. About 30 miles out of Shreveport a fire was discovered while en route in a T. & P. train. After the fire was extinguished the car was billed home empty for repairs. The G. N. billed the A. C. L. for $2,051.33, the total cost of repairs due to the fire damage. The A. C. L. refused to pay the bill, claiming that it was responsible only for the $225.00 damage and that the T. & P. was responsible for the remainder. The T. & P. contended that the second fire was a continuation of the first one on the A. C. L. and resulted from the failure of that road to completely extinguish the fire in the contents.

In a decision rendered April 10, 1947, the Arbitration Committee said, "The railroad in possession of car is responsible for fire damage occurring on its line. The Atlantic Coast Line, therefore, should issue defect card for items damaged while car was in its possession and, likewise, the Texas & Pacific should issue its defect card to cover the additional items damaged while car was in its possession. The Great Northern should then render bills against these railroads on basis of items shown on their respective defect cards. The contention of the Texas and Pacific is not sustained." *Case 1824, Atlantic Coast Line versus Texas & Pacific.*

* * *

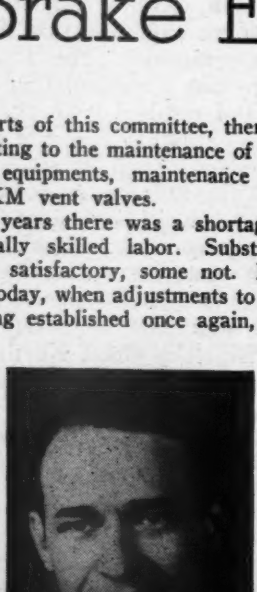
Canadian National photo

Making a welded repair at a rip track

Air Brake Equipment Report*

In previous reports of this committee, there have been papers and discussion relating to the maintenance of No. 6ET, No. 8ET locomotive brake equipments, maintenance of locomotive air compressors and KM vent valves.

During the war years there was a shortage of materials and man-power, especially skilled labor. Substitute material was used, some proved satisfactory, some not. Maintenance was a serious problem. Today, when adjustments to peace-time business and living are being established once again, there still remains



R. J. Dewsbury, Chairman

a shortage of material due to several causes and also a shortage of skilled labor.

This committee chose for this meeting a report on the proper protection of air brake equipment and its relation to maintenance.

The report is divided into sub-topics on strainer protection, lubrication, shipping and handling and the elimination of moisture.

The protection and proper handling of air brake devices go a long way toward assuring satisfactory performance in service

Strainer Protection Devices

By R. H. CANTZLER

Mechanical Expert, Westinghouse Air Brake Company

The importance of adequate and efficient strainer protection for air brake devices is generally well known to locomotive maintenance officers. Analysis of the residue found in the air cylinder of compressors which had been in service for some time and which were equipped with older and less efficient types of strainers revealed that over 60 per cent of the residue was iron oxide, 5½ per cent was sand and pieces of coked coal were also present. It is well recognized that the abrasive sand and coal contributed largely to piston ring and cylinder wall wear and valve leakage, although finely divided iron oxide has not been found to produce appreciable wear. Analysis of residue found in compressors equipped with modern "G" type filters shows no sand or coal present, and all iron oxide consists of very fine particles.

Shortly after the introduction of the improved Type G compressor intake filters and strainers a survey was made to determine the decrease in maintenance made possible through the use of more efficient air filters. One railroad reported the average service life of compressors with the improved filters and adequate lubrication to be 250,000 miles, or the period between shoppings, as compared with the previous average of 38,000 miles for the same class of engine. At the shopping it was found that 80 per cent of the compressors could have continued in service without renewal of any of the main piston rings. Another road reported average service life of 350,000 miles with some compressors exceeding 400,000 miles. Steam compressors in switching service, equipped with type G filters, were found to run four to six years without changing rings, while motor driven compressors, similarly equipped, increased their average maintenanc period to 18,000 hours of service on several properties.

The manufacturers have continuously conducted research with the object in view of providing the most efficient types of strainer for the different classes of service for which they may be required. The felt Staynew filter insert has been tested and found to be substantially 100 per cent efficient with very little restriction of air flow while operating in conjunction with steam driven compressors. When used with motor driven compressors in load-unload operation, however, oil vapor reaching the felt during the unloaded phase has a tendency to hold dirt particles on the surface of the strainer and thereby to restrict the air flow. For this type of operation, therefore, a wire mesh insert is recommended. The efficiency of the wire mesh insert depends on oil retained on the surfaces of the strainer element and with load-unload operation, oil is replenished from the compressor during the unloaded phase. Under consideration at the present time is an oil bath type of air strainer for use with motor-driven locomotive compressors in load-unload operation. This type is self-cleaning and will give longer service without attention but one possible disadvantage is the fact that oil and dirt will be taken into the compressor when the strainer element becomes completely clogged with dirt, whereas compressors equipped with wire mesh or felt filters will become less efficient with the restriction of the intake as the filters become clogged and thus call attention to the inoperative filter.

The maintenance of filters in clean and efficient condition will, therefore, be seen to be of great importance. Conditions of service will govern the most satisfactory cleaning intervals of filter and strainer elements. Many railroads have found it advisable to clean compressor intake filters at the quarterly inspection period. Instructions for cleaning and maintaining type G inserts are given in Instruction Pamphlet No. 5026. Dry dirt is dislodged from the felt strainer element by jarring on a hard surface and by the use of dry compressed air along the surface of the convolutions. Filters with oily dirt are cleaned with the aid of a hydrocarbon solvent. In this connection it should be noted that any type of lye solution will cause rapid destruction of the felt. The felt strainer with wire covering may also be cleaned by blowing air through the element in the reverse direction with the aid of a strainer cleaning device similar, in operation, to that used with the "AB" strainer but necessarily much larger. Wire mesh units are cleaned with a suitable solvent and blown clean after which

* From a Report of the Committee on Air Brakes presented before the meeting of the Locomotive Maintenance Officers' Association held at Chicago September 15 to 17, 1947.

oil is applied and the inserts are ready for further service.

Main reservoir line filter inserts are cleaned according to methods indicated for compressor intake filter units.

Dirt collectors and drain cups are used for the protection of air brake devices from abrasive materials and moisture and should be cleaned as experience dictates.

The Type E strainer incorporates the standard "AB" strainer unit and has been found to be of great advantage in decreasing the maintenance of air operated horns and compressor governors. For example, some roads have found it possible to increase the regular maintenance interval of governors from six months to the period between Class 3 repairs. The strainer unit is easily removed and cleaned inexpensively in the AB strainer cleaning device which may be found at all major railroad car cleaning terminals.

Strainers located in the non-pressure heads of locomotive brake cylinders have reduced cylinder wear and packing cup failures. These strainers, which are usually of the curled hair type should be cleaned when the cylinders are cleaned at locomotive shopping periods and renewed as found necessary.

Other strainers and filters are incorporated into various air brake devices for the protection of the complete devices of their component parts. In general these will be removed with the devices at their regular cleaning periods and cleaned or renewed in the air brake shop. Among these are included strainers in vent valves, brake pipe strainers of distributing and control valves, and charging chocke felts used in the D-24 Control Valve.

While it is not always possible to analyze the direct benefits attributable to any strainer in particular, experience has shown that the proper use of efficient strainers has resulted in greatly reduced maintenance through lack of wear and associated longer intervals between removal from the locomotives. Effective strainers have also led to more reliable functioning of air brake devices with consequent decrease of failures in service, which is of prime importance to locomotive department officials.

Importance of Careful Handling of Brake Equipment

By P. F. Conahan
General Air Brake Instructor, Virginian

Handling of air brake equipment, so as to insure that it will be applied to a locomotive in the best possible condition, is much more important than most of us realize. Keeping maintenance costs at the lowest possible level can only be accomplished if the parts involved are applied to the locomotive in as near perfect condition as possible. Maintenance costs rise or drop—sharply depending on the care used by the various men who clean, test, repair, and transport all the different air brake parts. Money spent to do this work should guarantee the longest possible service from the parts, but, due to conditions which we shall elaborate on in this paper—such is not always the case.

Anyone who has watched triple valves, feed valves, brake valves, distributing valves, and other parts come off a test rack in perfect condition, only to see them fail when applied to a locomotive, can picture the necessity of careful instruction and supervision of personnel in regard to the handling of this equipment. Parts, which due to improper handling, do not give proper length of service, or cause failures on the road, are responsible in a large part for high maintenance costs.

Centralization of air brake cleaning to as few points as possible, is one of the best ways to decrease maintenance costs. Centralizing the cleaning enables you to place the most capable men on the work, and they, in turn, can educate and train the younger and less experienced men.

Careless handling has reduced the life expectancy of many valves, necessitating the replacement of many of their working parts—caused innumerable failures—and, to an untold extent, increased maintenance costs. Probably the greatest single cause for improper handling of air brake parts is poor supervision, or—rather—a lack of supervision. Training in the right methods is of the utmost importance.

We all understand that a poorly trained man, rarely—if ever—becomes a good mechanic. Practical knowledge in the field of air brake work is very essential, but must be supplemented by the study of the proper air brake books. Supervision can help to a great degree, by demonstrating, instructing, and encouraging their men in the proper methods of handling parts. Education of air brake men—especially those whose duties are to handle, repair, and test the parts, has fallen sadly to the rear in recent years. Only by the intent interest of those of us now actively engaged in air brake supervision, can this condition be improved.

There are three principal places where careful handling of newly cleaned and repaired equipment will insure its giving satisfactory service, and thereby decrease maintenance costs. These three places are, namely and in order: *first,* the air brake room where the parts are cleaned and tested; *second,* transportation to, and later handling of the equipment by the stores department; and, *third,* the care and attention given the equipment by the men who remove it from and apply it to, locomotives.

How often have you seen valves of all kinds, which have passed a satisfactory rack test, carelessly removed and dropped heavily to the floor or bench? The sensitive parts in valves can easily be seriously injured, or even destroyed, by this practice. How often have you witnessed a man who has tested a valve, permit it to lie around uncovered where there is dust and dirt? How often have you seen men place the repaired valves where the face and passages can absorb all kinds of foreign bodies, which, later on, are carried into the valve itself? How many brake cylinder packing cups have been injured by improper application? Usually, the injury is to such an extent that they may have to be replaced as soon as the locomotive is tested out. How many brake cylinder walls have been scored by the men permitting foreign bodies to remain in the cylinder when they have assembled the brake cylinder piston? These are just a few things which add to maintenance costs.

Instruction and careful supervision to prevent these practices, are the primary essentials of a well-conducted air brake room.

The stores people are a big factor in increasing maintenance costs; parts turned over to them in perfect condition, are often found to be defective when applied to a locomotive. Careless and rough handling between the air brake room and the storehouse, often results in a part being rendered useless before it ever reaches a rack or bin in the storehouse. Improper storage of parts in the storehouse itself, very often results in defective equipment being shipped to outlying points. Rough handling of parts, when they are being placed in cars for shipment, and the same rough handling, when they are removed at their destination, is another instance for an increase in maintenance costs which is entirely unnecessary.

The adverse conditions under which men are sometimes forced to work, tends to make them careless. How often have you witnessed a man draw a new valve on a store order—take it to a locomotive and drop the valve down in the dirt beside the locomotive? How often have you seen a man remove a valve and never clean off the face of the gasket or examine the gaskets themselves before applying the new valce? Conditions of this kind often result in failure to pass the test device code and necessitate labor, which, naturally, increases maintenance costs. The subject of covers and containers for air brake parts, which are charged to outlying points, is one that should be given careful attention. The original cost of the proper cover or container is very slight, compared to the work it does toward safe-guarding the valve or piston which it contains.

The air brake room, which turns out the greatest percentage of parts which give the longest service, and, therefore, tends to decrease maintenance costs, is the one which observes these three rules:

1. Careful and intelligent handling of all parts.
2. Cleanliness of the room and its surroundings, including the test rack, benches, and all parts stored in the room itself.
3. Careful, intelligent, periodic inspection and instruction by the supervision in charge.

Any appreciable decrease in maintenance costs must, therefore, come from the close cooperation of all department and personnel actively engaged in the handling of these parts.

The report was signed by R. J. Dewsbury (Chairman), asst. gen'l air brake inspector, Chesapeake and Ohio; R. L. Holderby, air brake foreman, Chesapeake and Ohio; R. H. Cantzler, mechanical expert, Westinghouse Air Brake Co.; A. M. Malmgren, gen'l diesel supervisor, St. Louis—Francisco; R. S. Brown, service engineer, New York Air Brake Company and P. F. Canahan, gen'l air brake instructor, Virginian.

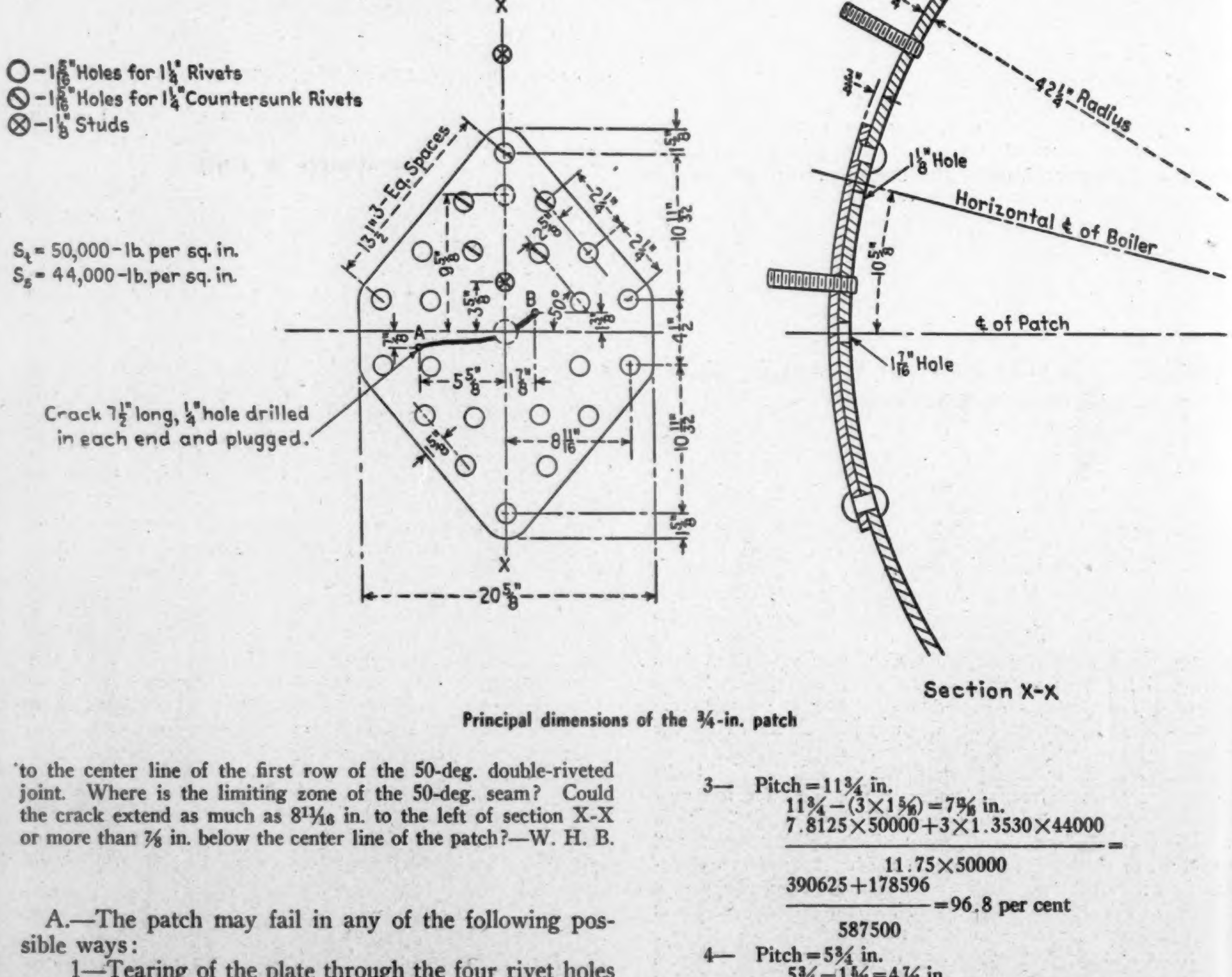
Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Computing Boiler Patch Efficiencies

Q.—Please analyze the various ways in which the patch shown on the attached print could fail, with particular attention along line A-B. In considering the efficiency along this line, may any allowance be made for the length of the crack? Please discuss the condition left of section X-X where the crack extends almost to the center line of the first row of the 50-deg. double-riveted joint. Where is the limiting zone of the 50-deg. seam? Could the crack extend as much as $8\frac{11}{16}$ in. to the left of section X-X or more than $\frac{7}{8}$ in. below the center line of the patch?—W. H. B.



Principal dimensions of the ¾-in. patch

A.—The patch may fail in any of the following possible ways:

1—Tearing of the plate through the four rivet holes in the first row plus shearing of seven rivets in single shear.

2—Tearing of the plate remaining in the shell along line A-B (through crack) plus shearing of nine rivets in single shear.

3—Tearing of the plate through four rivets in the second row plus three rivets in single shear.

4—Tearing of the plate through two rivets in the outer row plus one rivet in single shear. (bottom of patch)

5—Tearing of the plate through two rivets in the outer row, and through one 1⅛-in. hole plus one rivet in single shear. (top of patch)

6—Tearing of the plate between the four rivets in the outside diagonal row.

The efficiency in each of the above possibilities of failure is computed as follows:

1— $17\frac{3}{8}-(4\times1\frac{5}{16})=12\frac{1}{8}$ in.

$$\frac{12.125\times50000+7\times1.3530\times44000}{17.375\times50000}=$$

$$\frac{606250+416724}{868750}=117.7 \text{ per cent}$$

2— $17\frac{3}{8}-(7\frac{1}{2}+\frac{1}{4}+2\frac{5}{8})=7$ in.

$7\frac{1}{2}$ in. = crack including $1\frac{5}{16}$-in. dia. hole

$\frac{1}{4}$ in = two $\frac{1}{4}$-in. drilled holes

$2\frac{5}{8}$ in. = two $1\frac{5}{16}$-in. rivet holes

$$\frac{7\times50000+9\times1.3530\times44000}{17.375\times50000}=$$

$$\frac{350000+535788}{868750}=101.9 \text{ per cent}$$

3— Pitch = $11\frac{3}{4}$ in.

$11\frac{3}{4}-(3\times1\frac{5}{16})=7\frac{13}{16}$ in.

$$\frac{7.8125\times50000+3\times1.3530\times44000}{11.75\times50000}=$$

$$\frac{390625+178596}{587500}=96.8 \text{ per cent}$$

4— Pitch = $5\frac{3}{4}$ in.

$5\frac{3}{4}-1\frac{5}{16}=4\frac{7}{16}$ in.

$$\frac{4.4375\times50000+1\times1.353\times44000}{5.75\times50000}=$$

$$\frac{221875+59532}{287500}=97.8 \text{ per cent}$$

5— Pitch = $5\frac{3}{4}$ in.

$5\frac{3}{4}-(1\frac{5}{16}+1\frac{1}{8})=3\frac{5}{16}$ in.

$$\frac{3.3125\times50000+1\times1.3530\times44000}{5.75\times50000}=$$

$$\frac{165625+59532}{287500}=78.3 \text{ per cent}$$

6— Diagonal Pitch $= 13\frac{1}{2}$ in.
Longitudinal Pitch $= 8\frac{11}{16}$ in.
$13\frac{1}{2} - (3 \times 1\frac{5}{16}) = 9\frac{9}{16}$ in.

$$\frac{9.5625 \times 50000}{8.6875 \times 50000} = 110 \text{ per cent}$$

In designing a patch where additional holes are to be drilled in the shell, care should be taken not to weaken the shell as is apparent in the outer row at the top of this patch, failure method *5*, even though the tear to be considered is only through three holes. The patch would be improved by increasing the length of the top half so as to have five rivets in the outside diagonal row, thus obtaining a condition where there would be three rivets in single shear to support the tearing of the plate through the two rivet holes plus the one $1\frac{1}{8}$-in dia. hole between them.

In designing patches it is customary to accept the conditions as found on the boiler, and design the patch around these conditions so that the efficiency of the patch will at least be equivalent to that of the longitudinal seam of the course to which it is attached. In this particular case any increase in the length of the crack would reduce the efficiency as computed in formula *2*. When designing patches for cracks running longitudinally on the boiler, it is good practice to make the distance from the end of the crack to the nearest rivet measured longitudinally at least equal to the rivet spacing in the longitudinal seam of the course to which the patch is applied. For cracks running circumferentially, the distance from the end of the crack to the nearest rivet measured circumferentially should be at least equal to the rivet spacing of the adjacent circumferential seam.

Safety Platform for Locomotive Shop Use

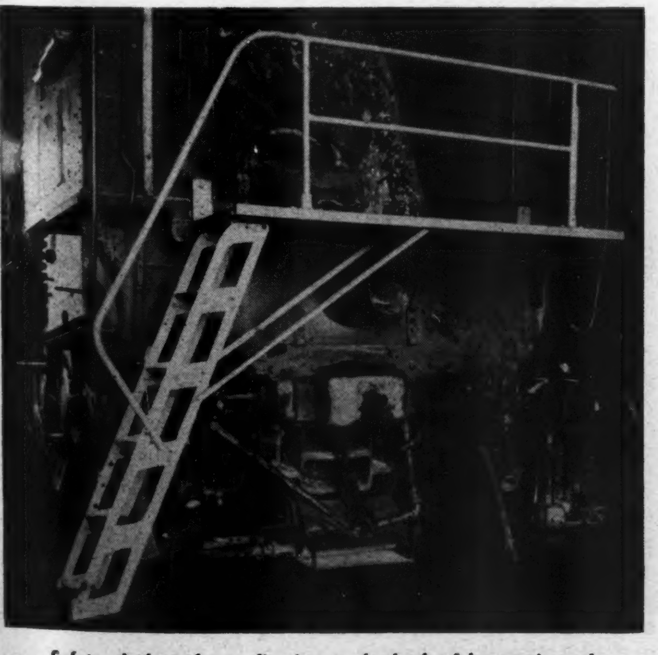
*By G. H. Raner**

The arrangement shown in the illustration permits easy and safe access to locomotive cabs by means of a fixed step ladder. The platform ladder is 14 in. wide, and the height or length of step ladder is governed by the type of locomotive most frequently repaired and by the distance from the cab floor to the shop floor. Sufficient clearance is allowed at the bottom of the steps to permit moving the locomotive without disturbing the step platform. The steps are tread steel $7\frac{1}{2}$ in. wide and $13\frac{1}{2}$ in. long, secured by two rivets at each end. The hand rail, which is a 1-in. diameter second-hand pipe, extends within convenient reach of one mounting the ladder and across the full length of the platform.

The platform is $96\frac{1}{2}$ in. overall in length and 24 in. wide. The deck is regular apron tread steel, secured by bolts and welds and fully supported by a 1-in. by $1\frac{1}{2}$-in. T-iron at the outside edge and a 1-in. by 1-in. by $\frac{1}{4}$-in. brace along the side next to the locomotive cab.

The step platform as a unit is bolted to the rear of the cab through holes where the apron is fastened. The bolting arrangement may be seen in the illustration.

* Special assistant, office of general superintendent of equipment, Illinois Central, Chicago.



Safety platform for application to the back of locomotive cabs

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

556—Q.—Where is the D-24-A *feed valve located? What is its function?* A.—The *D-24-A* feed valve, attached to the side of the pipe bracket, regulates the pressure in the brake pipe with the automatic brake valve handle in running position and in controlled release position.

557—Q.—Describe the regulation portion. A.—The regulating portion consists of the pressure adjusting handle *26* for setting regulating valve spring *21* and diaphragm *19*, so that regulating valve *27* permits the air at the required pressure to flow to the supply portion and thus control the air pressure delivered by the feed valve. Regulating valve spring *32* keeps regulating valve *27* seated when the delivered air pressure is at the upper regulating valve spring setting.

558—Q.—Describe the supply portion. A.—The supply portion consists of the supply piston *7* which operates supply valve *11* to admit or cut off the delivered air as controlled by the regulating portion. Supply valve spring *9* keeps supply valve *11* closed when the delivered air pressure is at the regulating valve spring setting.

559—Q.—What is the S-40-D *Brake Valve?* A.—The *S-40-D* is a self-lapping brake valve by means of which the locomotive brake cylinder pressure is controlled independently of the train brakes in accordance with the position of the brake valve handle in the application zone.

560—Q.—What is the duty of the self-lapping portion? A.—The self-lapping portion automatically laps off the flow of air when the applied pressure reaches the valve corresponding to the position of the brake valve handle.

561—Q.—How is the application and release of locomotive brake obtained? A.—Application of the locomotive brake is obtained by moving the brake valve handle to the right and release by moving to the left.

562—Q.—What does the S-40-D *Brake Valve consist of?* A.—The *S-40-D* Brake Valve consists of the following: (A)—Pipe bracket *85* to which all the pipe connections are made. (Fig. 10); (B)—Body portion *2* in which are housed the shaft with the various operating

cams, the application valve *25* which controls the opening to the independent application and release pipe, the controlled emergency valve *24* which vents controlled emergency pipe in Full Application position to cut out the controlled emergency feature, and the release pilot valve *105* which provides independent release; (C)—Pipe bracket filling piece *111* which is located between the pipe bracket *85* and valve body portion; (D)—Body portion *47* which houses the self-lapping unit; (E)—Handle guard *34* in which are located the brake valve operating handle *38*, shaft housing *6*, handle stop *4* and the release check valve operating bail *37*.

563—Q.—How many connections has the pipe bracket? A.—The pipe bracket *85* has four connections.

564—Q.—Name them. A.—*30*—main reservoir supply; *20*—which connects the brake valve to connection *44* of the K-2 Rotair, where a passage is provided in Freight or Passenger position to the Independent Application and Release Pipe and the D-24 control valve application and release portion; *13*—which connects the brake valve to connection *45* of the K-2 Rotair, where passage is provided in Freight or Passenger position to the Actuating Pipe and the D-24 control valve application and release portion; *35*—Controlled Emergency Pipe which connects the brake valve to connection *35* of the K-2 Rotair Valve and the controlled emergency portion of the D-24 control valve.

565—Q.—Name the brake valve handle positions. A.—The brake valve handle has three positions from left to right (1) Locking Position; (2) Release and running; (3) Application Position which includes the full application zone. Independent release after automatic application is obtained by depressing the S-40-D brake valve handle.

Questions and Answers On Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Repairing Center Castings

Q.—We have considerable wear on our engine-truck center castings, both male and female portion. How can satisfactory repairs be made to restore them to their original condition?—M. F. J.

A.—The male center casting should be removed and the center plate portion turned to a true diameter. Then build up the outside circumference of the center plate portion with weld for a distance equal to at least the amount the center plate engages the truck bolster. After welding is completed the center plate should be again turned to the required diameter. Where the rim of the female center plate portion of the bolster has sufficient stock, the inside diameter should be turned out ½ in oversize to a 3-in. minimum depth. A steel bushing should then be made to set into the center plate portion of the bolster, restoring it to its original diameter. This bushing should be welded in place, the weld being carried around the outside circumference of the bushing. The edges of the bushing and the bolster are beveled at 45 degrees for welding.

Running-Board Location

Q.—On some of our locomotives the injector delivery pipe runs along the boiler directly above the running board. The width of the running board complies with the Safety Appliance Standard for locomotives although the distance from the outside of the pipe to the edge of the runboard is slightly less than ten inches. Is there any rule that limits such a condition?—R. E. K.

A.—The safety appliance standards for locomotives provides that running boards shall be not less than 10 inches wide. If of wood they must be not less than 1½ in. in thickness; if of metal, not less than $\frac{3}{16}$ of an inch, properly supported. If the running boards on the locomotive comply with this rule they should be satisfactory; however, Section 2 of the Locomotive Inspection Law states: "It shall be unlawful for any carrier to use or permit to be used on its line any locomotive unless said locomotive, its boiler, tender, and all parts and appurtenances thereof are in proper condition and safe to operate in the service to which the same are put, that the same may be employed in the active service of such carrier without unnecessary peril to life and limb and unless said locomotive, its boiler, tender, and all parts and appurtenances therof have been inspected from time to time in accordance with the provisions of this Act and are able to withstand such test or tests as may be prescribed in the rules and regulations hereinafter provided for."

Under this section it becomes the duty of the carrier to operate the locomotive in a safe condition. If the condition outlined in the question would constitute an unsafe condition in that the runboard is obstructed in any way, it could be considered a violation of the inspection law even though the running board complies with the Safety Appliance Standards.

Advantages of Flame Priming

Q.—What are the advantages of flame-priming surfaces in preparation for painting?—M. K. V.

A.—The flame-priming process consists of passing over steel surfaces a series of closely spaced oxy-acetylene flames that have an extremely high temperature and velocity. As a result, all mill scale that is not tightly bonded is popped loose by sudden thermal expansion. At the same time, physically absorbed and chemically combined water is driven off from any rust that is present, leaving stable oxides in its place. Other contaminants present, such as oil, acids and salts, are also consumed or disintegrated by the flames. The surface is then swept or wiped free of loosened foreign materials and painted while still warm from the flames.

This procedure not only brings about improved corrosion resistance by the paint coating but also increases the cleaning and painting rates and reduces the setting time for the paint. As a further advantage, painting can be carried out under conditions of low prevailing temperature or dampness which would otherwise cause major delays. The time saved with the process is of particular importance at the present time when continuous production without delays in the fabrication and painting of steel is required.

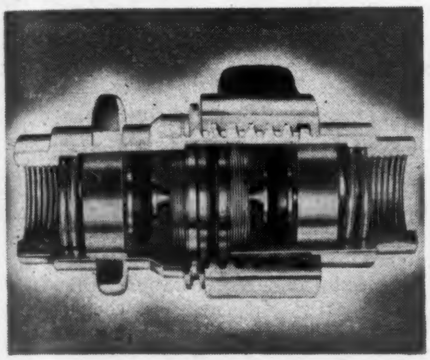
The process also finds increasing application in the reconditioning of previously painted surfaces that have become badly corroded and pitted, particularly industrial structures subjected to highly corrosive conditions. The action of the flames pops the heavy rust loose even in deep pits and drives off any chemical salts, acids, or gases that may be clinging to the surface. Materials, such as pipe that has been underground, are freed of mud and moisture simultaneously.

ELECTRICAL NEW DEVICES

Disconnect Coupling For Freon Lines

A quick-disconnect coupling for air-conditioned passenger cars which enables the changing out of the refrigeration unit with the least possible delay has been produced by the Paxton-Mitchell Company, Omaha, Neb. The coupling is applicable to several types of service such as air or hydraulic systems, although originally developed for freon refrigeration units. It is equally satisfactory on gases and liquids.

It is fabricated from extruded brass bar stock to eliminate the possibility of porosity which would resuult in leaks. It is compact and light in weight and closes tightly under the highest pressures encountered in freon refrigeration systems.



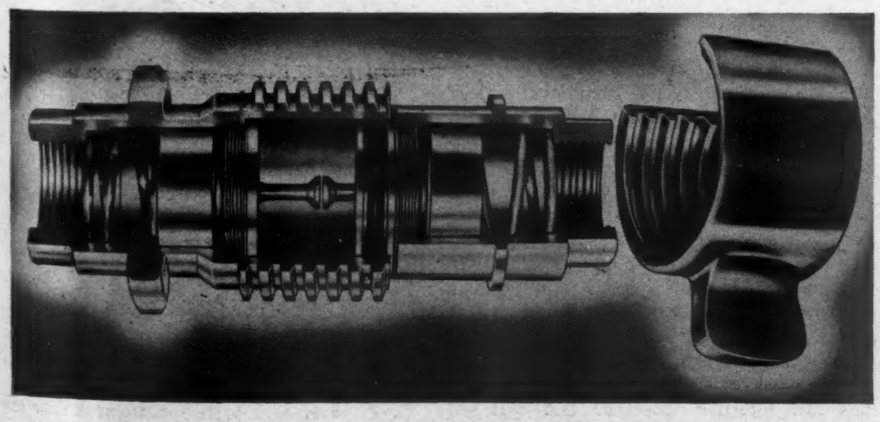
The process of drawing up the coupling opens the valves

It is made in ½-, ¾- and 1-in. sizes at the present time, and has a fast Acme thread which permits rapid opening of the union joint. The dual valves are self-closing as the union joint is broken.

Valve seats are of freon-resistant Neoprene. Valves are amply guided to eliminate cocking in the guides. Valve seats and guides are readily removable for replacement purposes when necessary. It incorporates provisions to relieve pressure between the valves while being disconnected.

Its design is such that in making up the union, a minimum quantity of air will be entrapped between the valve seats. The union nut can be supplied either as a hex nut or wing nut.

The couplings are applicable to air lines, water lines, oxygen lines, instrument lines, fuel lines, oil lines and other gases and fluids used for cooling, testing, refrigerating, lubricating, heating, air conditioning, processing, maintenance, truck trailers and other operations. It has been in actual service on trans-continental trains since early in May, as a means for changing out refrigeration units for service purposes without the necessity of pumping down.

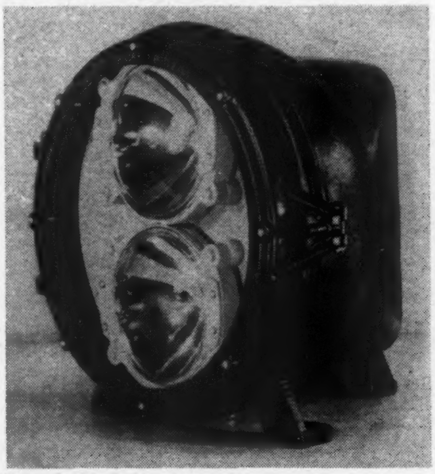


When the coupling is opened, the valves seal the freon lines

Sealed-Beam Headlights

A dual, sealed-beam locomotive headlight is now being made by the Mars Signal Light Company, Chicago, Ill., and adapters for such lamps, to permit their use in existing headlights are now undergoing development. The sealed-beam units now available are 200-watt, 30-volt Par--56 lamps developed by the lamp division of the General Electric Company and have a rating of 200,000 to 210,000 beam candle power.

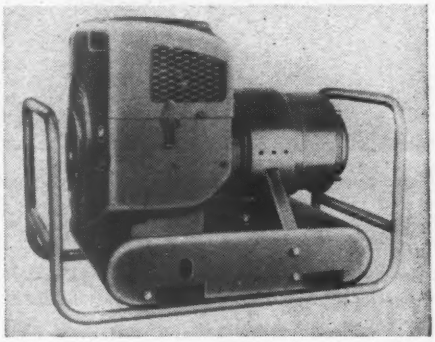
In the near future, similar units rated at 200 watts, and 12 volts will be available. These lamps will have a light output approximately 50 per cent greater than the 30-volt lamps.



The Mars sealed-beam headlight

Lightweight Electric Plant

A 5,000-watt electric plant weighing only 272 lb., has been announced by D. W. Onan & Sons, Inc., Minneapolis, Minn. An air-cooled, four-cycle, two-cylinder gasoline engine is used as a prime mover. A special winding on the generator serves as the cranking for starting. A 12-volt automotive type battery furnishes the starting power.



The units are made with either a.c. or d.c. generators

The engine is equipped with high-tension magneto ignition. A removable cast-aluminum engine hood protects the unit from dust and water. Opposed design and leaf-spring mounting assure smooth performance. There is a four-outlet receptacle for direct plug-in of loads.

Metals Comparator

An electronic instrument called the metals comparator has been introduced by the special-products division of the General Electric Company for providing a quick, non-destructive comparison of either magnetic or nonmagnetic metal parts with a standard. Parts appearing alike, but differing in composition, can be separated quickly with the instrument. It has been used to differentiate between annealed and unannealed steel bars, and also to sort finished metal parts with different compositions or heat treatments.

The metals comparator employs a balancing network and indicating instrument mounted in a steel cabinet to which is connected an external test coil. In operation, a reference specimen for the group of specimens being compared is first placed in the test coil and adjustment made to secure the initial balance. This is indicated by a zero reading on the indicator instrument. After the reference specimen has been removed, the parts to be tested are inserted briefly in the coil one by one. When tolerances have been established, specimens can be accepted or rejected on the basis of the dial reading. As many as 1,500 small parts can be tested in an hour.

The metals comparator is mounted in a steel cabinet about 11 in. by 17 in. by 22 in.; and weighs a little less than 60 lb. Test

The comparator as used for selecting pipe

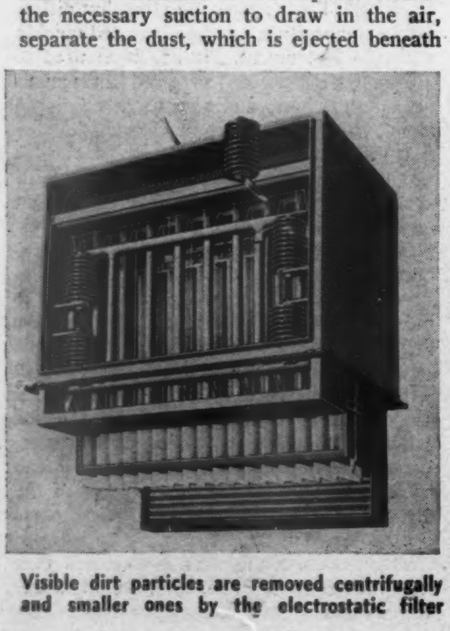
coils of different sizes are available, ranging from ½ in. to 3 in. inside diameter. Leads are of convenient length so specimens can be tested in any position adjacent to the instrument.

The equipment is designed for operation from 60-cycle commercial power supply at 115 volts. Because of the small size of the apparatus and the low power requirements, the instrument can be used most anywhere.

Electronic Filter With Rotary Precleaner

The American Air Filter Co., Louisville, Ky., has eliminated the use of pre-filters with its Electro-Airmat precipitator for railroad passenger-car air conditioning by the use of a motor-driven device called a Roto-Clone. It serves as both blower and precleaner, and requires no periodic cleaning and recoating with oil.

It is similar in appearance to a pressure-type blower, and the turbine-like impeller is composed of 48 blades attached radially to a disc-shaped base 25 in. in diameter. Rotation of the impeller creates the necessary suction to draw in the air, separate the dust, which is ejected beneath



Visible dirt particles are removed centrifugally and smaller ones by the electrostatic filter

the car, and discharge the cleaned air through the primary air outlet to the electronic air filters.

Cinders and dust particles down to 8 microns (a 10-micron particle is the smallest particle that can be seen by the naked eye) are removed from the air by the Roto-Clone. The remainder of the dust and smoke particles down to ¼ micron (1/100,000 in.) are precipitated by the Electro-Airmat.

Because of the variations in construction of different types of cars, the Electro-Airmat has been made available in two types for side or bottom servicing, with ionizers interchangeable. This is of particular advantage when, due to construction, a combination of the two designs may be required in a single car.

Communication Train Line Connectors

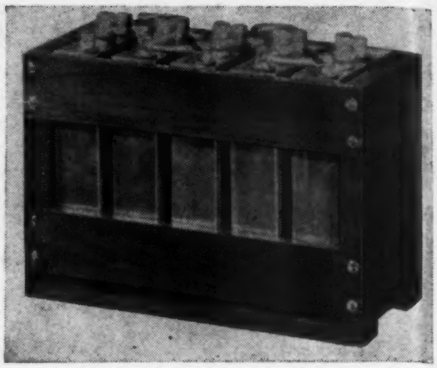
Plugs and receptacles for making connections between cars on electric train lines used for communication, radio and wire recordings are now being made by the Pyle-National Company, Chicago. They have fourteen poles or contacts and are de-

Pyle-National communication train-line plug and receptacle

signed in accordance with the A.A.R. standard as covered by circular ESM-53, prepared by the Committee on Application of Radio and Communications to Rolling Stock, Electrical Section, Mechanical Division, Association of American Railroads. The plugs and receptacles are now in production.

Cadmium-Nickel Storage Battery

Baker & Co., Inc., Newark 5, N. J., refiners of precious metals, has announced a cadmium nickel alkaline storage battery. Used in Europe for the past twenty years, the cadmium battery has been developed by Baker technicians to fit the needs of a wide variety of industries, including railway applications. The manufacturer states that the battery accepts high or low charge rates without finish rate limitations; that it has excellent capacities at low electrolyte temperatures with no danger of damage due to freezing; and that it does not produce fumes which will corrode steel or wood. It has a small spread between its charge and discharge voltages and is suitable for "floating" service applications. The battery has low internal resistance and will not self-discharge on open circuits.



A tray of Baker cadmium-nickel storage batteries of the type suited to railroad service

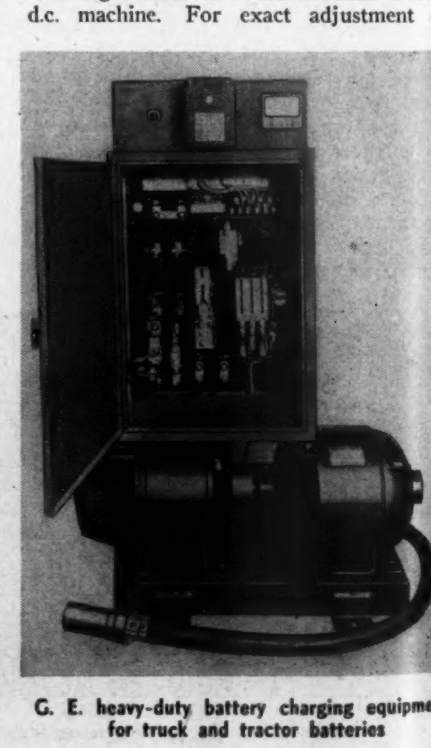
The battery is constructed of heavy, nickel-plated steel to withstand mechanical abuses. The active material is held firmly in perforated steel pockets to prevent shedding.

Battery Charger For Industrial Trucks

Improved heavy-duty battery charging equipment for industrial truck service, meeting all the standards of the Electric Industrial Truck Association, has been announced by the Motor Divisions of the General Electric Company. The equipment is packaged into one unit consisting of a single-circuit, battery-charging, motor-generator set, with its control cabinet mounted on a welded structural steel framework directly above. It is completely wired and assembled before shipment from the factory.

The equipment meets the requirements of an 18-cell, 550-amp. hr., lead-acid type storage battery. It charges the battery at the exact tapered charge rate that is indicated by the battery manufacturer as being necessary for longest life of the battery equipment.

The generator is a conventional 47-volt d.c. machine. For exact adjustment of



G. E. heavy-duty battery charging equipment for truck and tractor batteries

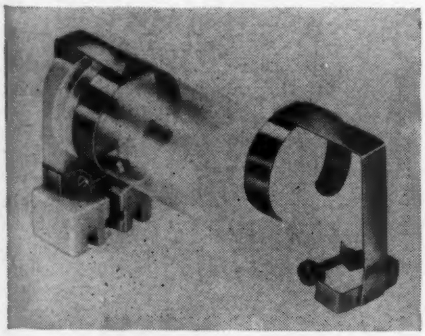
voltage, a slide-wire type resistor is used in the field circuit in place of the usual rheostat. This prevents tampering with the voltage after it has been set.

All the control devices are heavy duty type, the line contactor being of steel mill construction, and the motor starter a Size 2 across-the-line type.

The equipment is completely automatic. Connection of the battery to the terminals automatically starts the motor-generator set, and when it has attained synchronous speed, the line contactor to the battery circuit is closed automatically. As soon as the battery has reached a voltage representing 75 to 80 per cent of full charge, a timing device is actuated which cuts off the battery from the charging circuit on completion of the charge. This shuts down the motor-generator set and prevents overcharging the battery.

Fluorescent Lamp Guards

The Den-El Equipment Company, Irvington, N. J., has announced a fluorescent lamp guard that supports the ends of fluorescent lamps and prevents their falling out of lamp holders. The guard has proved valuable in preventing accidents, work in-



Springing of the guards permits removal or replacement of the lamp

terruptions and tube breakage particularly in industrial plants and in the presence of vibration.

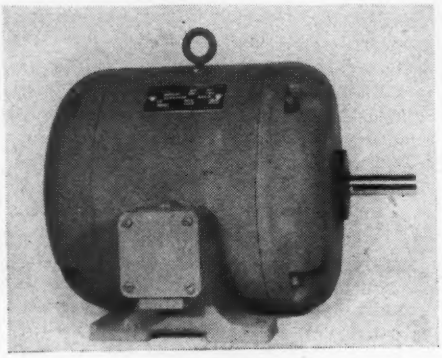
The guard is easily installed permanently with a machine screw and unit. It is made of stainless steel for lasting good appearance, and its resilience allows it to be sprung for cleaning or re-lamping. It is available in two sizes, for 40-watt and 100-watt lamps, respectively.

Totally Enclosed Three-Phase Motors

The Kato Engineering Company, Mankato, Minn., is now making three-phase motors in sizes of 1½, 2 and 3 hp. The squirrel-cage rotor makes use of rolled sheet-copper bars, this being done to guarantee uniformity and low internal rotor resistance.

The rotor is equipped with Norma-Hoffman grease-sealed cartridge-type bearings. Stator windings are completely submerged in varnish, and each winding is twice baked at moderate temperature until the varnish is properly cured.

Holes in mounting feet are spaced in



The motors are totally enclosed and the rotor cages are made of rolled sheet copper

accordance with N.E.M.A. standards. A special cast-iron outlet box threaded for proper size of conduit is mounted on the side of each motor. Frame and end bells are of cast-iron, and the motor is fitted with a lifting ring.

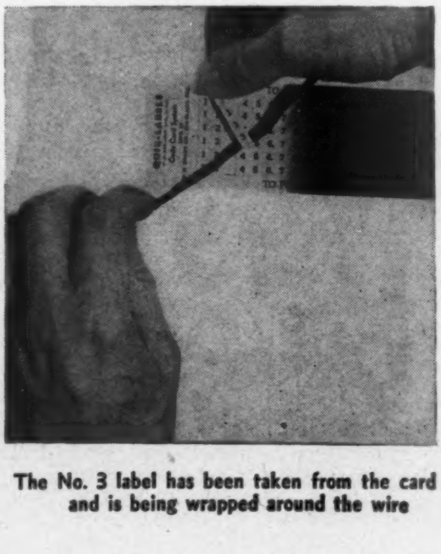
Narrow-Beam Floodlights

A lightweight, narrow-beam reflector makes General Electric's Type L-69 floodlight suitable for use in railroad yards, football stadiums, and other applications requiring concentrated light beams for high-efficiency illumination.

At long projection distances, the narrow-beam reflector is more efficient and economical than the heavy duty floodlights. It utilizes the lower-cost general lighting lamp in place of the floodlighting service lamp. The reflector provides a narrow beam of light with a spread of approximately 20 deg. and is interchangeable with the wide and medium units on Type L-69 floodlights. Features included, which save on installation and maintenance costs, are rifle-like sighting devices, relamping from the rear, impact-resistant spun-on front glass, and degree scales.

Wire Marker

Adhesive, wraparound, identifying strips are now being made by the W. H. Brady Company, 808 North Third street, Mil-



The No. 3 label has been taken from the card and is being wrapped around the wire

waukee 3, Wis. They may be used to identify electric circuit wires or cables, conduits, coils, relays, etc. The strips are supplied on cards, each card having a self-starter strip to permit easy removal of one label at a time.

Each one of the labels has its number repeated along the length of the strip, so that when it is wrapped around the wire, one may be seen from any angle. The outer surface of the strips is plastic coated for added protection, durability, and permanent legibility. The strips have high dielectric strength, and do not present the hazards of metal tags. They are 1½ in. long and may be cut in half to produce two ¾-in. strips for smaller diameter wire.

The strip cards are available in various colors, with a variety of designations. The maker states that they may be applied without moistening to any round or flat surface, and that they will not unwind, crack, or chip.

Close Temperature Control

A precision temperature-variation control instrument called the Xactline Capacitrol for electrically or gas-heated furnaces or ovens, has been announced by the Claud S. Gordon Company, 3000 South Wallace

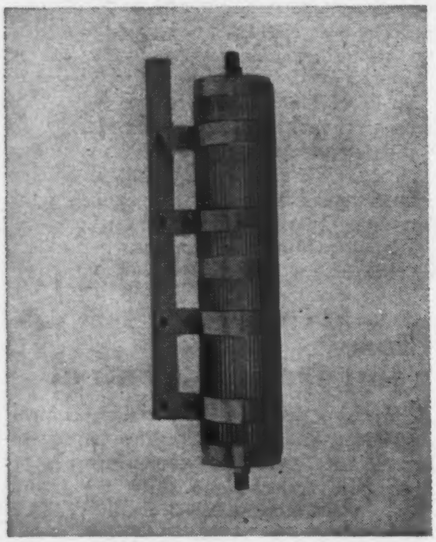
Complete Xactline control unit

street, Chicago 16. The instrument combines the features of the Gordon Company's control with the Wheelco Instrument Company's electronic Capacitrol. Depending upon the relation of actual temperature and pyrometer setting, the instrument anticipates a critical heat change before it occurs and will hold temperature tolerances as close as ⅛ deg. F. plus or minus with power "on-off" cycles as short as these three seconds. There are no gears, cams, motors, bearings or valves employed in the control; the only moving part is an internal relay. Two screw adjustments provide a practical sensitivity reaction range to meet most temperature-variation specifications.

High Capacity Rectifier

Selenium rectifiers, produced through a new method of electrolytically deposited selenium, have been developed by Ion Industries, Inc., Riverdale (Chicago 27), Ill. The rectifiers which are cylindrical in shape, employ liquid cooling to produce unusually high current capacity.

The rectifiers are constructed in standard

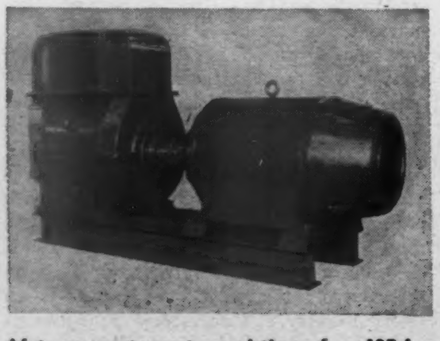


An S-300, 250-amp. rectifier

unit elements. Assemblies can be made in the number needed for the output in current and voltage required. Various series-parallel arrangements can be made to produce rectifiers ranging in capacity from 250 amp. for the standard single element to assemblies for large scale industrial applications. Suggested applications included metal deposition, metal refining, welding, etc. Aside from the recognized advantages of liquid cooling, a complete hermetic seal of the active surface area is included in the design to assure long life and trouble-free operation. A 250-amp. (continuous rating) unit is 16 in. high, 3 in. wide, and 6¼ in. deep, and weighs 4 lb.

Unit-Cooled Generators

A line of totally enclosed, unit-cooled generators has been developed by the motor division of the General Electric Company for use in motor-generator sets or in other generating applications in any non-hazardous atmosphere where the ratings in-



Motor-generator set consisting of a 135-hp. unit-cooled motor and a 90-kw. unit-cooled generator

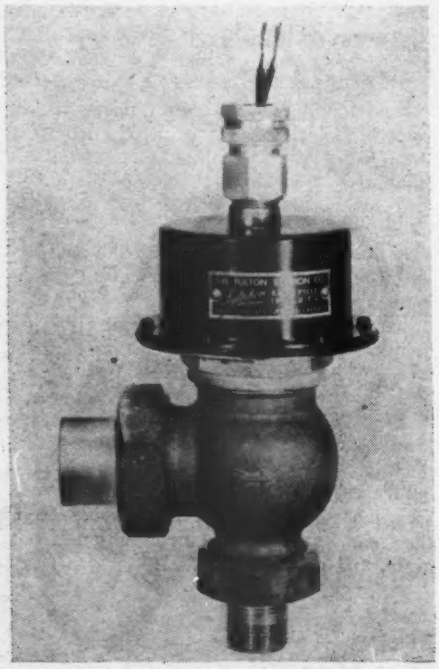
volved make totally enclosed fan-cooled construction impractical.

The generators are available in ratings from 30 to 150 kw. They are especially suitable for use in atmospheres commonly found in railroad shops, steel mills, cement mills, paper mills, and around large machine tools.

Cooling of the generator is accomplished by an air-to-air surface cooler which maintains safe winding temperatures at all times. When used in a motor-generator set with a totally enclosed unit-cooled d.c. motor, the entire unit is completely assembled at the factory and shipped ready for installation.

Weatherproof Heat-Control Valve

Fulton Sylphon Company, Knoxville, Tenn., has designed a type 9990-S electric valve with a weatherproof cap that permits in-



The valve is designed for installation under the car

stallation under the car. This valve operates on the heat-motor principle, i. e., the electrical circuit consists only of a resistor. The heat generated by this resistor expands a fluid into the hot-chamber Sylphon bellows in the valve body, where it is converted to a gas by the steam temperature surrounding the bellows. The gas pressure expands the bellows and closes the valve.

Earth Drill

A hydraulically controlled earth drill (model HBJ) has been developed by the Buda Company, Harvey, Ill. The machine drills 6-in. to 42-in. diameter holes to depths of 10 ft. Reducing the time required for making set-ups has been given particular attention in the design of the drill. It is intended for pole-line construction, pre-boring for piles, foundation hole work, and for other jobs which require the constant moving of equipment.

The drill is powered by a slow-speed four-cylinder Buda gasoline engine which, with the drilling mechanism, is mounted on an I beam of structural steel to make one complete and packaged unit. A flat-bed truck or a heavy four-wheel trailer is recommended for mounting the machine.

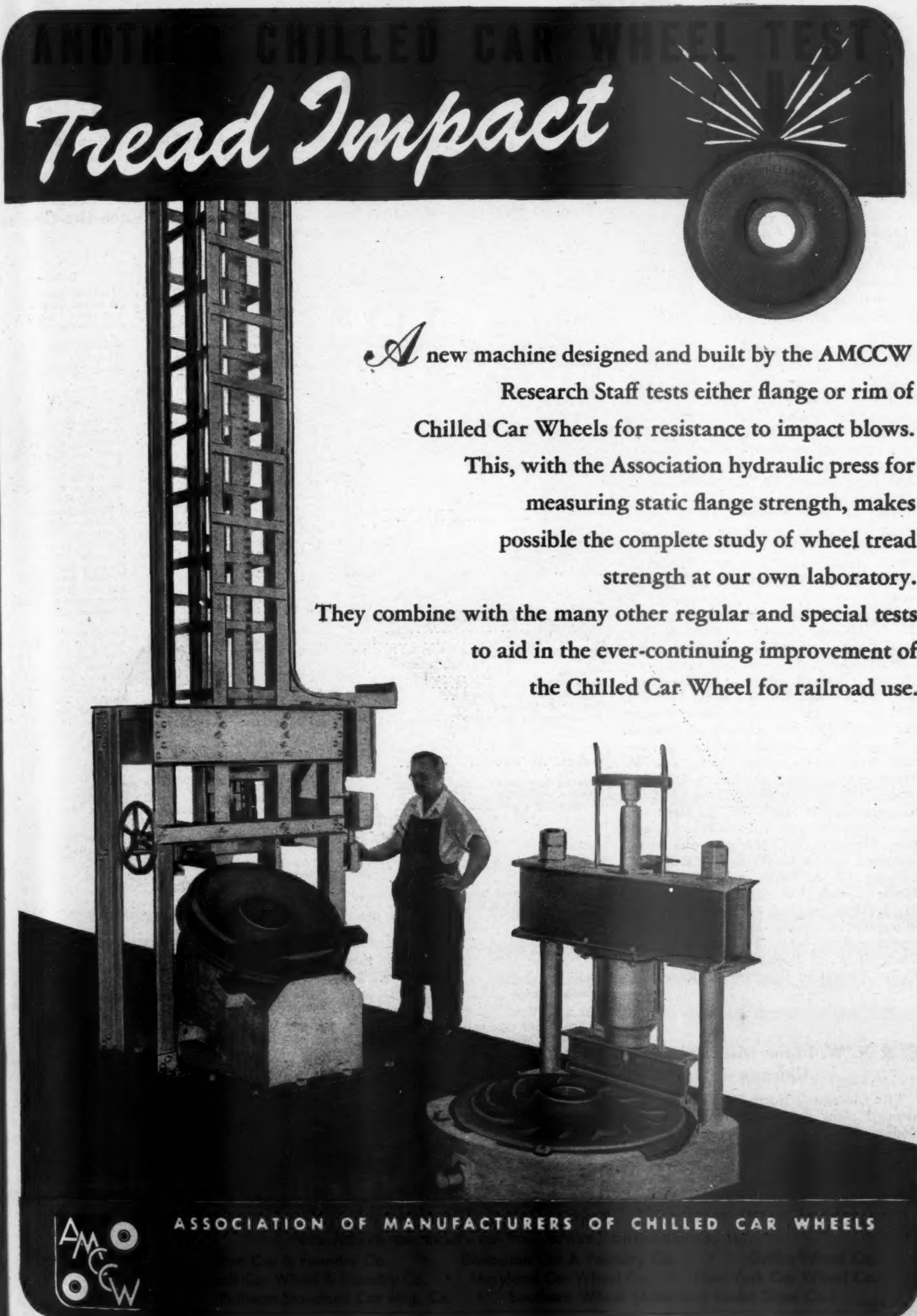
The machine will drill holes from 8 in. to 42 in. in diameter to depths of 10 ft.

A pole-setter tower extension and power driven winch, furnished as optional construction, is a factory installed part of the unit for power-pole work.

Painting with Metal

Molten metal spray is being used effectively to protect other metal from corrosion. Frames and panels of Westinghouse radio-communication equipments have been protected in this manner, in which the steel was first shot-blasted and then "painted" with a film of molten zinc. The method is being applied regularly to the protection of shunt capacitors for pole mounting where ordinary paints have seemed inadequate because the handling during installation often scores the surface, paving the way for early corrosion. It is being applied also to transmission-line protector tubes and may be extended to other communication equipments, train-radio sets, and broadcasting equipments located in certain localities.

Particular merit of the metal-spray protection is that the coat can be made as thick as desired whereas with galvanizing the zinc is more limited in thickness. By molten-metal spraying, surfaces up to eight mils have been applied readily to capacitor surfaces. Even if the sprayed metal is scored all the way through to the base steel, corrosion is less likely to ensue because of the more favorable relationship of zinc and steel in the electro-chemical series—oxidation of steel being in part a galvanic phenomenon. Sprayed metal requires no time to dry whereas conventional baking methods require both furnace equipment and time. The coating has its final durability as soon as applied.



For additional information, use postcard, pages 53-54

NEWS

Chicago Car Men Celebrate Fiftieth Anniversary

THE Car Foremen's Association of Chicago celebrated the fiftieth anniversary of its founding at an annual meeting and ladies' night held Friday evening, October 10, in the grand ballroom of the Lasalle hotel, Chicago. President L. W. Dobbins, division general car foreman, New York Central, presided and there was a total attendance of about 1,000 members and guests.

Preceding the entertainment program, a short business meeting was held and the following officers elected for the ensuing year: president, C. L. Spees, mechanical department, Union Tank Car Company, Chicago; first vice-president, C. A. Mick, office manager, mechanical department, Chicago, Burlington & Quincy, Chicago; second vice-president, W. J. O'Brien, general car foreman, New York, Chicago & St. Louis, Chicago; treasurer, C. J. Nelson, superintendent of interchange, Chicago Car Interchange Bureau, Chicago; secretary, W. E. Angier, chief clerk, A. A. R. department, Chicago, Burlington & Quincy, Chicago.

The board of directors elected includes: H. L. Hewing, district general car foreman, Chicago, Milwaukee, St. Paul & Pacific, Chicago; A. L. Miller, general car foreman, Wabash, Chicago; H. B. Atherton, car foreman, Chicago Great Western, Chicago; A. H. Peterson, superintendent car department, Belt Railway of Chicago, Chicago; L. W. Dobbins, division car foreman, New York Central, Chicago; L. W. Shollmeyer, assistant to chief maintenance officer, General American Transportation Corporation, Chicago; W. J. Demmert, sales representative, Griffin Wheel Company, Chicago; O. C. Heckart, sales representative, Cardwell Westhouse Company, Chicago; R. A. Burke, purchasing agent, Mather Stock Car Company, Chicago; M. J. Mills, general car inspector, Pere Marquette, Wyoming, Mich.; H. B. Reed, superintendent yards, Pullman Company, Chicago; J. J. Root, Jr., vice-president, Union Tank Car Company, Chicago.

C. & N. W. Plans Diesel Shop at Chicago

THE Chicago & North Western has announced plans for the construction of a modern Diesel locomotive servicing and repair shop at Chicago. Contracts covering the work, which will cost approximately $1,800,000, have been awarded to S. N. Nielsen Company, Chicago.

The new shop will be located north of Kinzie St., just west of Pulaski road, where the North Western's general shop facilities are located. It will be built of red brick, wth extensive use of glass block panels, and will have an overall length of 404 ft. The main building will be 249 ft. by 138 ft. and a utility addition will measure 154 ft. by 60 ft.

The main building will contain five tracks, three of which will run through it, to be used for general servicing. The fourth track will be for heavy overhaul

Orders and Inquiries for New Equipment Placed Since the Closing of the October Issue

Locomotive Orders

Road	No. of locos.	Type of loco.	Builder
Canadian Pacific	10[1]	Pacific, pass.-frt.	Montreal Loco. Co.
	12[1]	Mikado, heavy frt.	Montreal Loco. Co.
	30[1]	Pacific	Canadian Loco. Co.
Chicago & Eastern Illinois	6	1,500-hp. Diesel-elec. pass. (4 A and 2 B units)	Electro-Motive
Elgin, Joliet & Eastern	25[2]	2,000-hp. Diesel-elec. transfer	Baldwin Loco. Wks.
Southern Pacific	3[3]	6,000-hp. Diesel-elec. pass.	American Loco. Co.
Spokane, Portland & Seattle	3	1,000-hp. Diesel-elec. switch.	Electro-Motive

Freight-Car Orders

Road	No. of cars	Type of car	Builder
American Steel & Wire Co.	30	70-ton gondola	Haffner-Thrall
Atlanta & West Point	20	50-ton hopper	Pullman-Standard
Atlantic Coast Line	1,800	50-ton box	American Car & Fdry.
	1,000	50-ton hopper	American Car & Fdry.
	200	50-ton pulpwood	American Car & Fdry.
	100	70-ton phosphate	American Car & Fdry.
	60	Covered hoppers	American Car & Fdry.
	800	50-ton gondola	Pullman-Standard
Birmingham & Southern	128	70-ton hopper	Pullman-Standard
Canadian Pacific	30	Caboose	Company shops
	750	Box	National Steel Car
	100	Covered hopper	National Steel Car
	175	Refrigerator	National Steel Car
	250	Hopper	Eastern Car
Chesapeake & Ohio	1,000	50-ton gondola	Pressed Steel Car
	500	70-ton covered hopper	Ralston Steel Car
	150	Caboose	American Car & Fdry.
Chicago, Burlington & Quincy	150[4]	70-ton covered hoppers	Company shops
Chicago, Milwaukee, St. Paul & Pacific	750	Automobile	Company shops
Erie	1,000	50-ton hopper	American Car & Fdry.
	700	50-ton box	American Car & Fdry.
	100	70-ton covered hopper	Ralston Steel Car
Georgia	75	50-ton hopper	Pullman-Standard
Gulf, Mobile & Ohio	50	70-ton mill type gondola	Pressed Steel Car
Lehigh & New England	100	70-ton covered hopper	American Car & Fdry.
Norfolk & Western	2,000	70-ton hopper	Company shops
St. Louis-San Francisco	500	55-ton hopper	Pullman-Standard
	300	Box	Pullman-Standard
	300	55-ton hopper	Pressed Steel Car
	200	70-ton covered hopper	Pressed Steel Car
Seaboard Air Line	300	50-ton high-side gondola	American Car & Fdry.
	100	50-ton low-side gondola	American Car & Fdry.
Western Maryland	1,000	55-ton hopper	Bethlehem Steel
Western of Alabama	30	50-ton hopper	Pullman-Standard
Wheeling & Lake Erie	1,000	70-ton hopper	Ralston Steel Car

Freight-Car Inquiries

Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	750	70-ton drop-end gondola	
	200	70-ton covered hopper	
	200	70-ton triple hopper	
New York Central System	2,000	55-ton hopper	
(for Pittsburgh & Lake Erie)	1,000	70-ton hopper	
Union Pacific	1,500	70-ton hopper	
	500	70-ton gondola	
	500	50-ton gondola	

Passenger-Car Orders

Road	No. of cars	Type of car	Builder
Canadian Pacific	10[5]	Mail-express	Canadian Car & Fdry.
	10[5]	Baggage-express	Canadian Car & Fdry.

[1] The Pacific type passenger-freight and the heavy Mikado type locomotives will cost $3,600,000; the 30 lighter Pacific type, $3,800,000. This is part of a $22,500,000 appropriation for new equipment recently authorized.

[2] The 25 new locomotives have been ordered after extensive use of the original single-unit 2,000-hp. engine, delivered to the E. J. & E. in May, 1946, in both road and yard operation. Certain improvements will be incorporated in the latest engines, including a "dressing up" of the appearance with changes in contour of the ends and the cab, and the addition of streamlined skirting. A walkway will be provided at each end for use of switching crews and maintenance men. The cab will be lengthened to allow more room.

[3] Estimated cost $2,000,000.

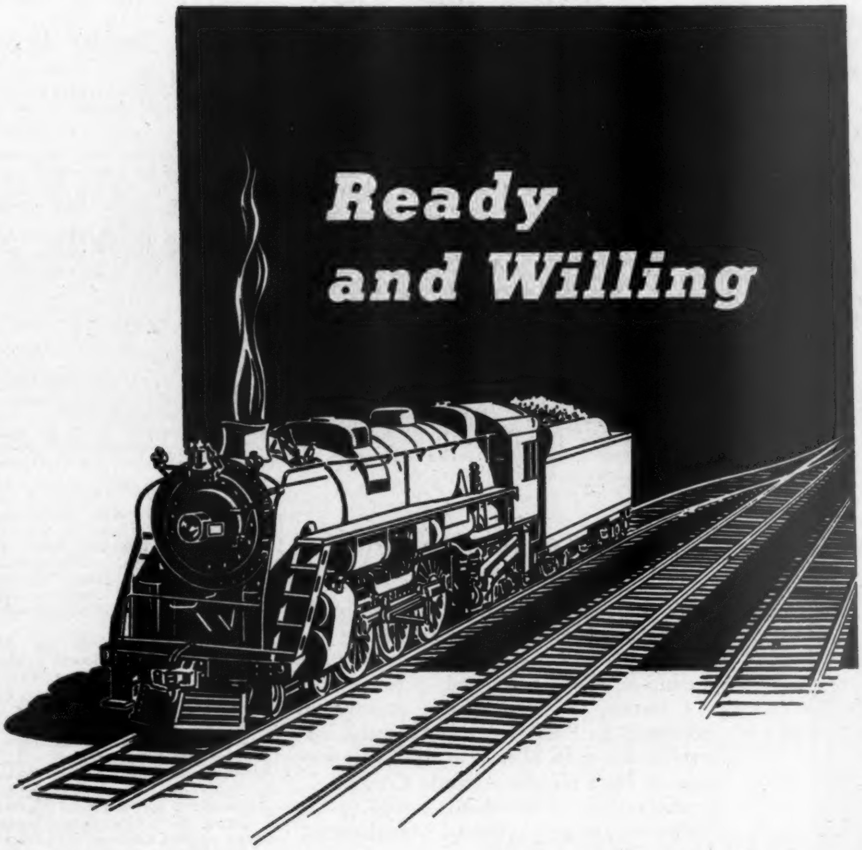
[4] Estimated cost $700,000. An additional 100 70-ton covered hoppers will be acquired on a lease-purchase basis from the Shippers Car Co.

[5] The 20 cars will cost about $1,000,000.

NOTES:—

Chicago & North Western.—The delivery of 11 2,000-hp. Diesel-electric passenger locomotives to the Chicago & North Western was begun last week at the rate of one unit each day, according to an announcement by R. L. Williams, president. With the receipt of the new motive power—built by the Electro-Motive Division of General Motors Corporation—the North Western will have received 30 Diesels since the first of the year.

Union Pacific.—The Union Pacific, which last March began equipping 300 stock cars with Timken roller bearings and other improvements for the inauguration of high-speed livestock service, will spend $771,500 to so equip an additional 500 stock cars to meet the shipper demand for this type of service. The total cost for refitting the 500 cars is as follows: bearings, $392,000; steel wheels, $50,500; improved springs, $41,000; and twin-cushion draft gears, $288,000. All rebuilding and reconditioning will be done at the road's shops. The 300 cars now being reconditioned at a cost of $463,000 are being used extensively in fast, nonstop Diesel-operated freight service between Salt Lake City, Utah, and Los Angeles, Calif.



but WAITING FOR RE-ASSIGNMENT!

The modern steam locomotive was designed to be a high revenue producer. The engineers that design them use all their skill to make possible a high monthly mileage. The railroads that buy them count on this mileage. Yet the locomotive's potential money making capacity is often stymied because scheduling has not been revised to take full advantage of the improvements in steam locomotive design.

Modern steam locomotives are more efficient because they can haul heavier payloads at higher sustained speeds. Study the availability of your modern power. Streamline schedules to use this power to the fullest. Operating results will prove that modern steam power, given the chance, is more than capable of meeting today's and tomorrow's traffic demands.

LIMA HAMILTON CORPORATION

LIMA, OHIO
Lima Locomotive Division
Lima Shovel and Crane Division

LIMA-HAMILTON CORPORATION

HAMILTON, OHIO
Hooven, Owens, Rentschler Co.
Niles Tool Works Co.

For additional information, use postcard, pages 53-54

work and the fifth will be a truck release track. A drop pit will run the full width of the main shop, serving all five tracks. An overhead crane with a 75-ft. span will operate the full length of the main building.

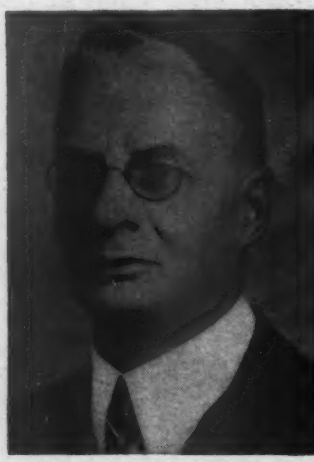
The utility building, a wing of the main structure, will have three floors, the first of which will be used for the storage of supplies. The second floor will contain stores, offices, a filter and parts cleaning room, injector and governor room and a parts reconditioning room. The third floor will contain employees' lunch, locker and shower rooms.

The new plant is expected to be put in service, handling Diesel locomotive repairs for the system, by the fall of 1948.

H. O. Hill American Welding Society President

THE American Welding Society has elected Harold O. Hill as its President for the year 1947-48. Mr. Hill assumed that office on October 24 at the conclusion of the 1947 annual meeting at the Hotel Sherman, Chicago.

Mr. Hill is assistant chief engineer, Fabricated Steel Construction, Bethlehem Steel Company, Bethlehem, Pa. He was born in Ontario, Canada, and was educated at the University of Toronto, from which he received the degree of B. A. Sc. in Mechanical Engineering.



H. O. Hill

His engineering career began with the Riter-Conley Company of Pittsburgh, Pa., fabricators of plate and structural steel. Here he served in many capacities and was chief engineer when the Company was merged into McClintic-Marshall Company in 1916. He then became assistant chief engineer of the enlarged company in charge of the engineering on tank and plate work. When the McClintic-Marshall Company was merged with the Bethlehem Steel Company in 1931 he continued the same duties with the Bethlehem Steel Company.

Mr. Hill has held many offices in the society and has been on numerous committees during the 16 years he has been a member. He is also a member of several other technical professional societies, and a registered professional engineer in Pennsylvania.

E. G. Bailey Elected A. S. M. E. President

E. G. BAILEY, vice-president of the Babcock & Wilcox Co., New York, has been elected national president of the American Society of Mechanical Engineers, for the ensuing year. Four regional vice-presidents and three directors-at-large have also been named.

G. N. Dieselizes Montana Line

THE receipt of three 3,000-hp. Diesel-electric freight locomotives and four single-unit 1,500-hp. passenger Diesels during October completes the Great Northern's Dieselization of its Great Falls, Mont.-Butte line, according to T. F. Dixon, operations vice-president. Two of the freight Diesels are for service between Havre, Mont., and Great Falls, and the third for operation between Great Falls and Butte. The new passenger units will operate between Butte and Havre and between Billings and Sweet Grass. All of the units were built by the Electro-Motive Division of General Motors Corporation.

A.S.M.E. Annual Meeting Program

AN educational exhibit of equipment and materials reflecting recent engineering and scientific developments in the field of jet propulsion, gas turbines, and nuclear energy will feature the 1947 annual meeting of the American Society of Mechanical Engineers which is to be held at the Chalfonte-Haddon Hall Hotels, Atlantic City, N. J., December 1-5. The exhibit, loaned by the Armed Forces and industrial organizations, will be scattered throughout the lounge floor, parlor, gallery, and solarium of the headquarters hotels.

Sessions sponsored by the professional divisions and technical committees of the Society are expected to total about 74. While the complete program was not available for the November *Railway Mechanical Engineer,* the tentative program for the Railroad Division sessions is as follows:

Tuesday, December 2

9:30 a.m.

METALS ENGINEERING (I) — RAILROAD (I)
Auspices of Metals Engineering and Railroad Divisions

Construction and Maintenance of Railroad Equipment by Submerged and Gas-Shielded Electric Welding, by Norman G. Schreiner, manager, Unionmelt service and development, Linde Air Products Company.

Notes on the Design and Construction of Staybolted Locomotive Fireboxes, by Fred P. Huston, charge railroad development, Development and Research Department, International Nickel Company.

Wednesday, December 3

9:30 a.m.

RAILROAD (II)
Auspices of Railroad Division

Presentation of Report on Railway Mechanical Engineering, by T. F. Perkinson, manager, Railroad Rolling Stock Division, General Electric Company.

Forum—Locomotive Developments

Better Locomotive Servicing Facilities on the Norfolk & Western, by C. E. Pond, assistant to superintendent motive power, Norfolk & Western.

Some Important Considerations in the Design of Coal-Burning Steam Turbine Locomotives, by John S. Newton, assistant manager engineering, Steam Division, Westinghouse Electric Corporation.

Streamlining Effect on Air Resistance and Smoke Lifting on Steam Locomotives, J. F. Griffin, chief engineer, Superheater Company.

The Effect of Foundation Brake Equipment on Emergency Stop Distances, by C. D. Stewart, vice-president, Westinghouse Air Brake Company.

The South African Railways from a Mechanical Engineer's Aspect, by M. M. Loubser, chief mechanical engineer, South African Railways.

Paper by John I. Yellott, director of research, Locomotive Development Committee.

Paper by Walter Giger, Steam Turbine Department, Allis-Chalmers Manufacturing Company.

The Turbine Locomotive and Transmission Systems, by Rupen Eksergian, vice-president, research, Budd Company.

Pennsylvania 2,000-hp. Streamline Diesel Road Locomotive, by J. C. MacInnes, supervisor, Application Engineering Department, Diesel Products, Baldwin Locomotive Works.

2:30 p.m.

RAILROAD (III)
Continuation of Forum—Locomotive Developments

Thursday, December 4

9:30 a.m.

RAILROAD (IV)
Forum—Freight-Car Construction

Paper by J. D. Loftis, chief motive power and equipment, Atlantic Coast Line.

Economics of Application of High-Strength Steel in Freight Cars, by A. F. Stuebing, assistant to manager of sales, High Strength Steel Division, Carnegie Illinois Steel Corporation.

Paper by S. M. Felton, president, American Railway Car Institute.

Weight Reduction—Freight Cars, by Robert B. Borucki, chief engineer, Railway Division, and E. A. Sipp, manager, Reynolds Metal Company.

Weight Reduction—Freight Cars, The A. A. R. Standard Air Brake AB Single Capacity Freight Brake Equipment, by H. N. Sudduth, director of air brake engineering, New York Air Brake Company.

Development and Trend in the Design of Hopper Discharge Type of Railway Cars, by George A. Suckfield, construction engineer, Pressed Steel Car Company.

Freight-Car Construction, by G. B. Hauser, assistant chief engineer, Railroad Division, Aluminum Company of America.

Paper by M. S. Downes, assistant general manager, Railway Division, Timken Roller Bearing Company.

Freight Car Truck Progress, by R. B. Cottrell, chief mechanical engineer, American Steel Foundries.

2 p.m.

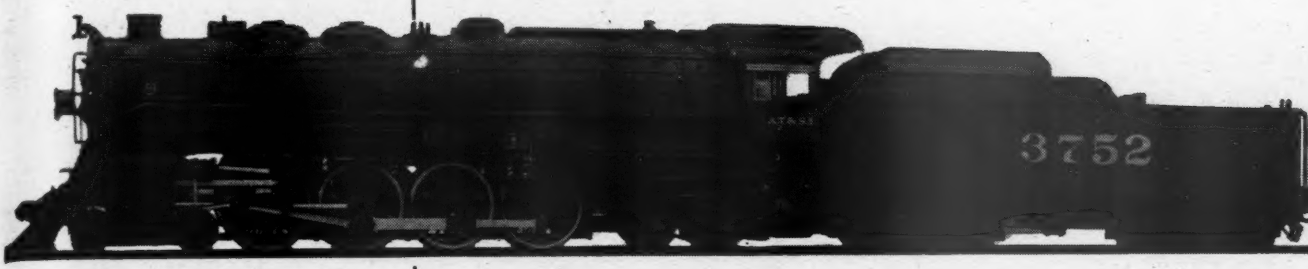
RAILROAD (V)
Continuation of Freight-Car Construction Forum

* * *

New Furnace for Carnegie-Illinois

The latest addition to the partially completed No. 12 blast furnace of the Carnegie-Illinois Steel Corporation, at South Chicago, makes it among the largest in the world. It is one of three such blast furnaces built by United States Steel Corporation plants in the Chicago area since the war.

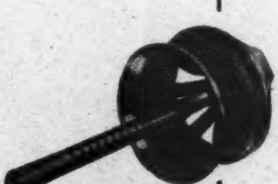
SANTA FE



Built — 1928
Type 4-8-4
Service — Passenger and Freight
Cylinders 30" x 30"
Driving Wheels 80"
Boiler Pressure 230 lbs.
Steam Chest Temperature 645° F.

equipping this locomotive with the Franklin System of Steam Distribution

The Franklin System of Steam Distribution, Type B — with poppet valves, rotary drive, and continuous contour cams — is now being installed on this 4-8-4 locomotive of the Santa Fe.



FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

 For additional information, use postcard, pages 53-54

Supply Trade Notes

AMERICAN LOCOMOTIVE COMPANY.—*H. C. Pentecost,* elevation engineer of the American Locomotive Company at Schenectady, N. Y., retired on July 1 after 48 years of service.

◆

VALVE PILOT CORPORATION.—*George F. McGowan* has been appointed assistant to the vice-president of engineering of the Valve Pilot Corporation.

Mr. McGowan began his business career with the General Electric Company in 1932 as an engineering apprentice and subsequently worked there as engineer until 1937. He became mechanical engineer of the Tennessee Coal, Iron & Railroad Co. in November, 1937, and in May, 1941, was appointed research engineer of the American Locomotive Company. During the period 1942 to 1945 he served with a railroad Diesel-shop battalion sponsored by American Locomotive, spending a year and a half in Persia on the Trans-Iranian railroad, followed by a year and a half of overseas duty with the combat engineers. He then resumed his duties as research engineer of the American Locomotive Company.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*Norman B. Johnson,* manager of freight car plants of the Pullman-Standard Car Manufacturing Company, has been appointed to the newly created post of assistant executive vice-president, with headquarters at Chicago. *Steven G. Peterson,* formerly superintendent of the car department of the Seaboard Air Line, has been appointed service representative of the Pullman-Standard.

Norman B. Johnson joined the American Car & Foundry Co., at Chicago, in 1909, as

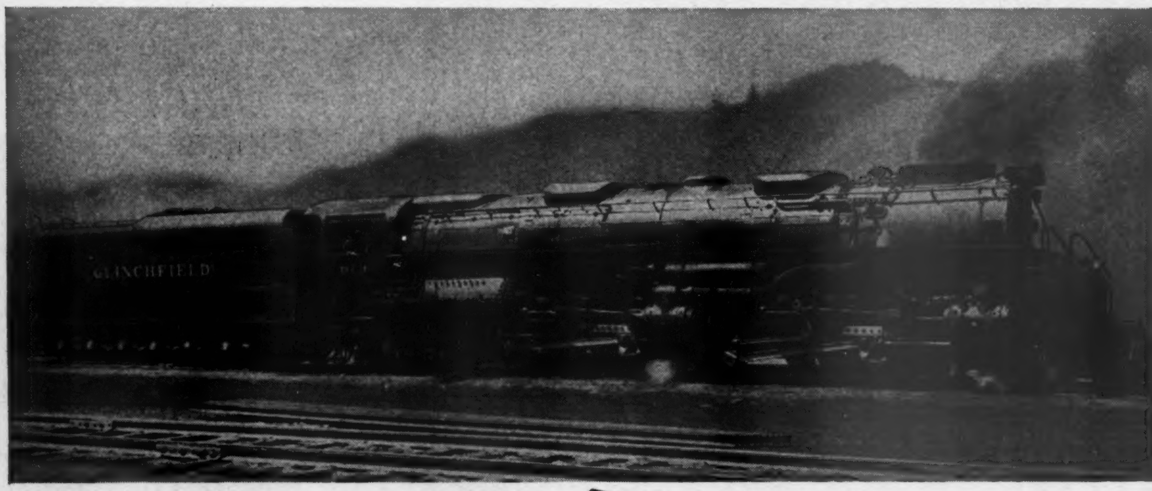
Norman B. Johnson

a draftsman. In 1916 he entered the employ of Haskell & Barker, at Michigan City, Ind., where he served successively as die engineer, chief draftsman, and assistant superintendent. In 1935, several years after the merging of the Haskell & Barker and Pullman interests. Mr. Johnson was as-

For additional information, use postcard, pages 53-54

Security Circulators

IN HEAVY MOTIVE POWER



on the Clinchfield Route

● Each of the six 4-6-6-4 steam locomotives recently placed in service by the Clinchfield Railroad Company, to haul heavy coal trains over southern mountain grades, is equipped with five Security Circulators.

Security Circulators improve the circulation of water in the boiler; aid in maintaining steaming capacity; reduce honeycombing, flue plugging and cinder cutting; permit the use of a 100% arch, and prolong the life of arch brick.

AMERICAN ARCH COMPANY, INC.

NEW YORK • CHICAGO

SECURITY CIRCULATOR DIVISION

For additional information, use postcard, pages 53-54

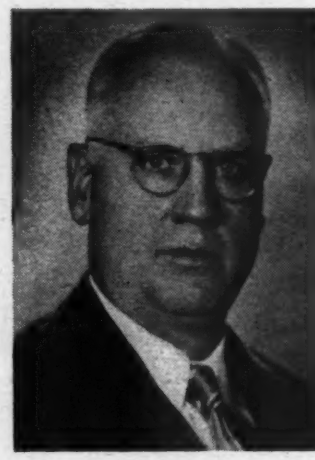
signed to the Chicago plant as liaison officer to the president, and subsequently acted as chief engineer of Pullman-Standard. In 1938 he was appointed manager of freight car plants.

Steven G. Peterson entered railroad service 1920 as a draftsman in the employ of the New York Central and transferred to the Seaboard in 1925. In 1932 he was appointed shop engineer at Norfolk, Va., assistant master car builder in 1940; general foreman of the Portsmouth, Va., shops in July, 1944, and superintendent of the car department in July, 1946.

◆

General Steel Castings Corporation.—*William E. Burdick* has been appointed engineer of tests of the General Steel Castings Corporation.

Mr. Burdick, after graduating from Stanford University in 1925 with an A. B. degree in mining and metallurgy, joined



William E. Burdick

the engineering department of the Commonwealth Steel Company. He remained with that company and its successor, General Steel Castings, in engineering and service work and was assistant manager of service and inspection at the time of his recent appointment as engineer of tests.

◆

Simmons-Boardman Publishing Corporation.—Fred Smith has been appointed sales representative for all transportation publications of the Simmons-Boardman Publishing Corporation, with headquarters at Chicago. Mr. Smith was born at Coal Valley, Ala., on December 31, 1910, and after graduation from high school completed a course in civil engineering with the International Correspondence Schools. During the summer vacations of 1924 and 1925, he was a rodman with the Dixie Construction Company. In 1926 he entered the service of the state highway department of Alabama as transitman and draftsman, and in 1929 was employed as an extension clerk by the Birmingham Electric Company. In January, 1936, he became a bridge inspector for the Woodward Iron Railroad Co., in May, 1936, transitman-draftsman of the Birmingham Southern, and on February 1, 1941, party chief of Alvord, Burdick & Howson, consulting engineers, Chicago. Five months later he joined the Chicago, Rock Island & Pacific as engineer-estimator. In January, 1945, when he entered the serv-

For additional information, use postcard, pages 53-54

HONOR ROLL OF GM DIESEL PASSENGER LOCOMOTIVES ON THE BURLINGTON

(As of August 1, 1947)

Locomotive Unit No.	Miles Assigned	Miles Operated	Per Cent Availability
9900	2,220,513	2,122,111	95.6
9902	2,512,763*	2,389,638*	95.1**
9903	2,107,335	2,029,448	96.3
9908	1,535,882	1,454,802	94.7
9904	3,038,876	2,766,886	91.0
9905	3,248,625	2,984,858	91.9
9906-A	3,945,204	3,596,872	91.2
9906-B	3,946,607	3,526,289	89.3
9907-A	3,954,756	3,644,229	92.1
9907-B	3,966,935	3,757,352	94.7
9909	1,731,186	1,671,457	96.5
9910-A	2,041,264	1,905,308	93.3
9910-B	2,037,622	1,946,588	95.5
9911-A	2,012,302	1,940,088	96.4
9911-B	1,990,946	1,946,453	97.8
9912-A	1,998,589	1,928,709	96.5
9913	1,426,903	1,376,076	96.4
9914-A	1,568,891	1,440,107	91.8
9914-B	1,541,887	1,489,852	96.6
9915-A	1,651,352	1,599,139	96.8
9915-B	1,588,905	1,526,324	96.1
9916-A	405,742	403,674	99.5
9916-B	402,741	401,920	99.9
9917-A	410,538	410,538	100.0
9917-B	405,653	405,653	100.0
9918-A	403,414	394,672	97.8
9918-B	393,640	393,089	99.9
9919-A	408,873	407,243	99.6
9919-B	406,000	406,000	100.0
9920-A	403,471	397,779	98.6
9920-B	419,941	419,941	100.0
9921-A	371,337	371,337	100.0
9921-B	374,894	374,343	99.8
9922-A	365,405	352,731	96.5
9922-B	366,934	365,680	99.7
9923-A	372,330	370,677	99.6
9923-B	382,866	374,941	97.9
9924-A	400,265	398,197	99.5
9924-B	390,190	390,190	100.0
9925-A	318,082	318,082	100.0
9925-B	342,001	341,127	99.7
9950-A	2,087,033	2,026,997	97.1
9950-B	2,085,895	2,017,032	96.7
9980-A	2,092,229	2,008,455	96.0
9980-B	2,092,013	2,017,130	96.4
Total 45	66,168,560	62,810,014	94.9

**Including estimated mileage on B-RI and CB&Q prior to August 4, 1945.*

***Since returned to CB&Q, August 4, 1945.*

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS — LA GRANGE, ILL.

ice of Simmons-Boardman as associate editor of the Railway Engineering & Maintenance Cyclopedia, at Chicago; on October 16, 1945, was appointed associated editor, purchases and stores, of Railway Age, and on June 1, 1946, associated editor in charge of purchases and stores.

◆

National Malleable & Steel Castings Co.—*Roy C. Hobson* has been elected assistant to the vice-president in charge of sales of the National Malleable & Steel Castings Co. Mr. Hobson joined National Malleable in 1928, as a member of the road service division of the railway sales department, and two years later he was transferred to the specialty development department. He was appointed chief inspector at the Sharon,

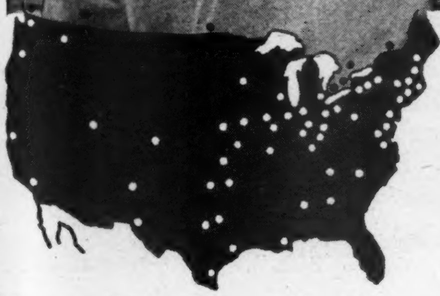
Roy C. Hobson

Pa., plant in 1938 and in 1944, was assigned to engineering work on company products. In 1945 he was appointed assistant sales manager of the Chicago works sales department.

◆

Electro-Motive Division, General Motors Corporation. — The Electro-Motive Division of the General Motors Corporation has announced the following organizational changes; *R. L. Terrell*, district sales manager at Washington, D. C., has been appointed general parts manager, with headquarters at LaGrange, Ill. *W. D. Davis*, parts manager at LaGrange, has been appointed head of the newly created service repair department, with headquarters at LaGrange. *A. O. Myers*, manager of the demonstration section of the sales department, at LaGrange, has been appointed district sales manager at Washington, D. C. *W. E. Dunn*, regional service manager, at Chicago, has been appointed assistant to regional manager, in charge of sales, service, and parts activities, with headquarters at Denver, Colo. *A. R. Walker*, sales representative at Chicago, has been appointed regional service manager, with headquarters at Chicago. *F. T. Battey*, product application engineer, at LaGrange, has been appointed assistant regional service manager, at Chicago, succeediog *L. H. Chancey*, who has been appointed district engineer, at Chicago. *G. R. Oesterreich*, district engineer, Barstow, Calif., has been appointed district engineer, Chicago.

R. L. Terrell, general parts manager at La Grange, was born at Dayton, Ohio, in



All Clear!

ALL CLEAR! . . . for trouble-free performance on every run—that's the meaning of *Honeywell Service.* Honeywell engineers are ready to help you from the "drawing-board" stage through the complete life of every installation—your assurance of one single standard of dependable operating efficiency. And to provide such service, Honeywell has 60 branches from coast to coast, including division offices that specialize exclusively in automatic control for railroads.

Today, Honeywell engine temperature control systems for diesel locomotives, air conditioning control systems for passenger cars and journal bearing alarm systems are providing stepped up efficiency, operating economy, safety, and new concepts of comfort for passenger travel.

The important thing to remember is that every one of these installations is backed by both the 63 year Honeywell reputation for dependable controls and by Honeywell Service as well. Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Toronto 12, Ontario.

MINNEAPOLIS
Honeywell
RAILWAY CONTROLS DIVISION

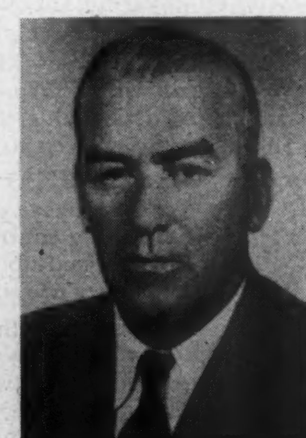
For additional information, use postcard, pages 53-54

1918, and entered G. M. service in 1936 as an apprentice in the research laboratory, at Detroit, Mich. After service of a year and a half in the Army Air Forces as an engine mechanic and a short period in the G. M. research laboratory, he joined the Electro-Motive Division as a service engineer in 1939. In 1941 he became an installation engineer on the G. M. pancake Diesels going into SC boats, and in 1942 Mr. Terrell entered the United States Navy as a lieutenant, junior grade, and was sent to England as an advisor on the maintenance of American built engines. He returned to the Bureau of Ships in Washington, D. C., in 1943, and until V-J Day was head of the Navy's worldwide internal combustion engine reclamation program. After V-J Day

R. L. Terrell

he was in charge of the disposal of surplus Navy engines. In November, 1945, he left the Navy with the rank of lieutenant commander, and returned to the Electro-Motive Division. He was sent to Washington, D. C., as sales representative, and in October, 1946, became district sales manager.

A. O. Myers, the newly appointed district sales manager of the Electro-Motive Division at Washington, D C., was born in



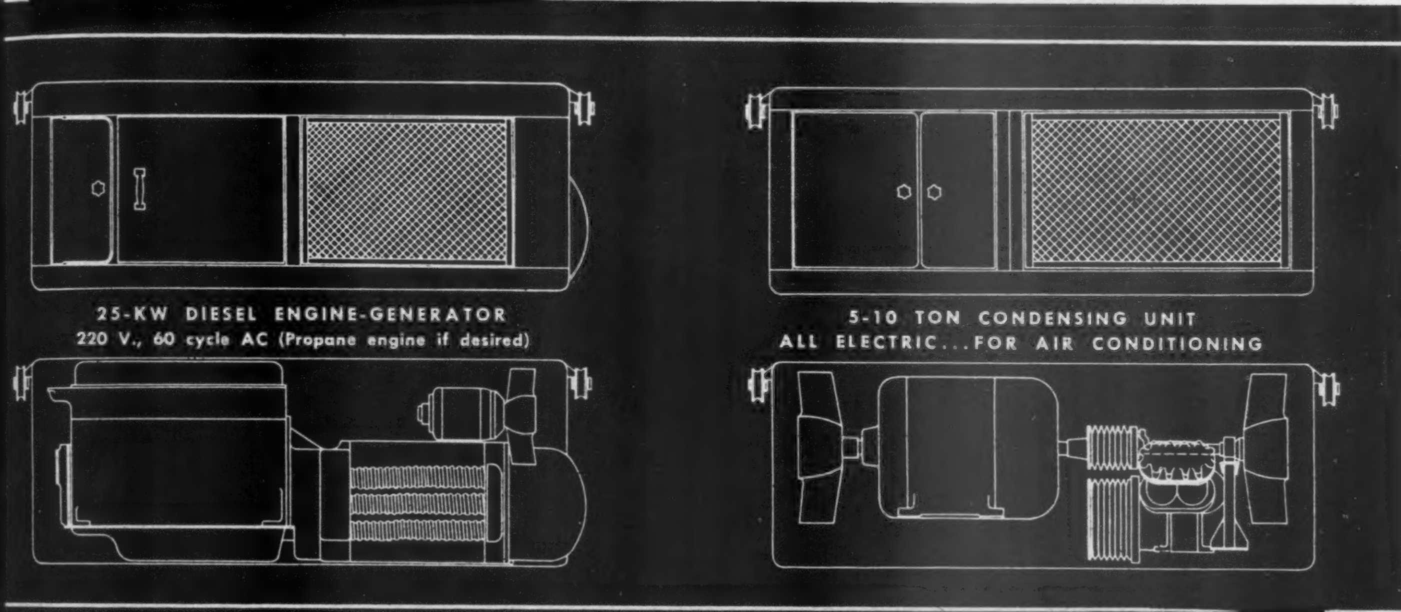
A. O. Myers

New York City and is a graduate of the Ohio State University. He joined the Saginaw Steering Gear Division of G. M. in 1928, and came to the Electro-Motive Division in 1942. During World War II he served in the Transportation Division of the War Production Board, at Washington, D. C., and then in the Washington office of

For additional information, use postcard, pages 53-54

Passenger Car Progress... WITH WAUKESHA

latest air conditioning equipment



...companion units supply all services...air conditioning, water cooling, lighting and emergency heating for passenger cars

● These self-contained units are package equipment. Easy to install! Easy to service! Easy to exchange for maintenance! A development of Waukesha's ten years' experience in building similar equipment of which more than 2500 units are in service on 35 railways.

25-KW DIESEL ENGINE GENERATOR — Directly connected to a six-cylinder, 60 hp. Diesel engine (propane if desired) and driven at engine speed through a fluid coupling, is the 25-KW AC Generator. The generator is tightly enclosed, and cooled by a unique self-contained cooling system.

Fluid drive permits the simplest possible method of synchronizing and load distribution. Any number of generators or alternators may be used for multiple unit operation in train lining.

Satisfies 110-Volt electrical needs—The standard AC alternator supplies 220 Volts, 60 cycle, 3-phase current. For illumination and light equipment loads, a 110 Volt constant voltage type transformer is employed, so that illumination voltage is automatically stabilized when the system is heavily loaded.

For electrical heating, 80% or 20-KW of the engine generator's output is available in the heating season.

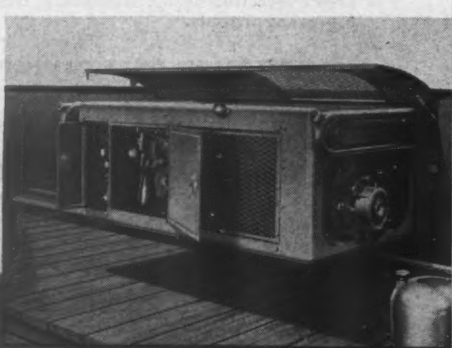
For an all-electric dining car — for cooking, warming compartments, toasters, mechanical refrigeration, and air conditioning, the load usually exceeds 25-KW. Here two 25-KW units operating in parallel is a simple solution of the problem.

AIR CONDITIONING

ELECTRIC DRIVEN CONDENSING UNIT has a capacity of 5-10 tons. A complete package, it includes two large air condensers. Like the engine-generator, it has the well-known Waukesha "roll out" mounting.

The compressor, driven by a 2-speed 15 hp. motor is the standard V-type. It provides 10 tons at 900 r.p.m. and 5 tons at 450 r.p.m. Designed for heavy duty with a ball-bearing crankshaft and full floating drive pulley.

Write for complete information



Waukesha 25-KW Diesel Engine-Generator "rolled out" for inspection

RAILWAY DIVISION
WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
Largest Builders of Mobile Engine-Driven Air Conditioning and Generator Equipment

the Electro-Motive Division. He was appointed manager of the demonstration section in 1946.

W. D. Davis, who has been appointed to head the newly created service repair department of the Electro-Motive Division, was born in Topeka, Kan. After completing his studies at Kansas State College, he took special Diesel training at General Motors Institute, Flint, Mich. He worked on G. M. Diesel engines at the Cleveland

W. D. Davis

Diesel Engine Division, at Cleveland, Ohio, from 1933 to 1935, when he was transferred to the service department of the Electro-Motive Division at La Grange. In December, 1939, he became service office engineer; in July, 1942, assistant service manager, and in February, 1944, parts manager.

◆

Oakite Products, Inc.—Oakite Products, Inc. has announced the expansion of its railway service division with the appointments of *J. Craig Ellis* and *Frank J. Darden* to its staff of special railway service representatives in the field. Mr. Ellis will work out of the Chicago office and Mr. Darden's headquarters will be in St. Louis, Mo.

◆

American Steel & Wire Co. — *C. F. Wiley* has been appointed assistant manager of the district sales office of the American Steel & Wire Co., a subsidiary of the United States Steel Corporation, with headquarters at Chicago.

◆

Union Asbestos & Rubber Co.—*Lewis J. Silverman* has rejoined the Union Asbestos & Rubber Co., as vice-president and general counsel.

◆

Timken Roller Bearing Company.—The Timken Roller Bearing Company has announced the appointment of *H. C. Edwards,* formerly chief engineer of research and development, as director of research and development, to succeed *J. F. Leahy,* who has retired after 45 years of service with the company. *Walter F. Green,* formerly assistant manager of research and development, has been appointed manager of research and development. *H. M. Shank,* formerly Boston, Mass., branch manager of the service-sales division, at Detroit, Mich., has been appointed branch manager, to suc-

Spicer

announces the Models 6 and 6-I

POSITIVE GENERATOR DRIVES

now being furnished for the new railway cars

● The Models 6 and 6-I Spicer Generator Drives incorporate new developments, to still further increase the excellent performance records made by more than 4000 Drives on over 40 railroads in the United States and Canada.

WRITE FOR DESCRIPTIVE BULLETIN

43 YEARS OF Spicer SERVICE

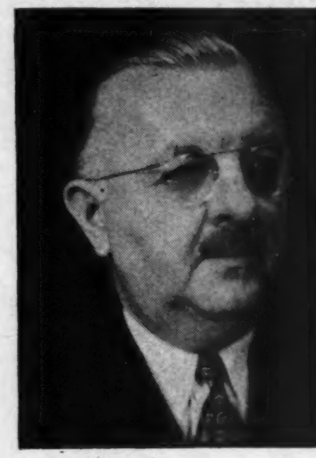
SPICER MANUFACTURING
Division of Dana Corporation
TOLEDO 1, OHIO

ceed *J. D. Jesseph*, resigned. *Frank M. Barry*, formerly a field representative in the New York office, has been appointed manager of the Boston branch.

◆

BUFFALO FORGE COMPANY.—*James E. Mossell* has been appointed sales manager of the machine tool division of the Buffalo Forge Company, to succeed the late *Earle G. Leonard*.

Mr. Mossell has been associated with Buffalo Forge for 35 years, more than 25 of which have been in machine tool sales. He has represented the company in Pennsylvania, Michigan, Canada and New England.



James E. Mossell

◆

GLOBE STEEL TUBES COMPANY.—*Frederick K. Krell*, formerly sales service supervisor for the Globe Steel Tubes Company, has been appointed Chicago district sales representative.

Obituary

FRANCIS J. WHITE, electrical engineer of the Okonite Company, died on October 4. Mr. White was 67 years old.

Personal Mention

General

VICTOR E. AMSPACHER, foreman of the chemical laboratory of the Pennsylvania, has been appointed chief chemist, in charge of the chemical laboratory of the test department at Altoona, Pa., assuming the duties of the late T. W. Fisher, assistant engineer of tests-chemical.

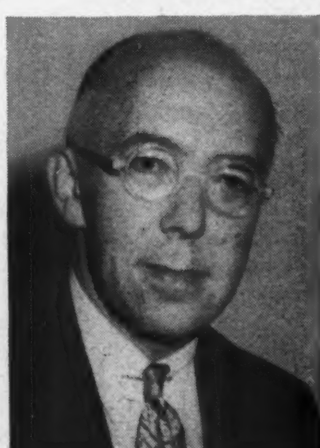
J. H. SALTZGABER, whose appointment as superintendent of equipment of the Cleveland, Cincinnati, Chicago & St. Louis (part of the New York Central system), with headquarters at Indianapolis, Ind., was reported in the October issue, was born in Van Wert county, Ohio, on October 28, 1893, and entered the service of the New York Central in 1910 as a machinist apprentice. On June 1, 1928, he bacame night enginehouse foreman, at LaFayette, Ind.; on December 1, 1928, enginehouse and car foreman, at Benton Harbor, Mich.; on August 16, 1929; night enginehouse foreman at Kankakee, Ill., and on July 10, 1930, engine-

house foreman at Kankakee. Mr. Saltzgaber was appointed general foreman at Cincinnati, Ohio, on May 1, 1939, and five months later assistant master mechanic,


J. H. Saltzgaber

with headquarters at Bellefontaine, Ohio. On July 1, 1942, he became master mechanic, at Indianapolis, and on May 1, 1946, assistant superintendent of equipment.

Ernest K. Bloss, whose appointment as mechanical engineer of the Boston & Maine, the Maine Central and the Portland Terminal at Boston, Mass., was reported in the October issue, was born at Worcester, Mass., on April 16, 1896. He attended the Worcester public schools and Worcester Polytechnic Institute, receiving his B.S. degree in 1918 and his E.E. degree in 1921. During 1918 and 1919 Mr. Bloss was assistant power and electrical engineer, Remington Arms U. M. C. Co., and from June, 1919, to June, 1920, research assistant, Westinghouse Electric & Manufacturing Co., then becoming railway engineer in the


Ernest K. Bloss

general engineering department of the latter company. From September, 1925, until the following June, Mr. Bloss was a salesman for the Chamberlin Metal Weatherstrip Company. In November, 1926, he became assistant electrical engineer of the B. & M.; in September, 1929, he was appointed supervisor rail motor cars, and in January, 1944, supervisor Diesel maintenance and operations of the B. & M., the Maine Central and the Portland Terminal.

Car Department

W. C. Meyer, superintendent car department of the Illinois Central at Centralia, Ill., is on leave of absence due to illness.

W. B. Henley, general car foreman at Mattoon, Ill., has been appointed assistant superintendent of the car shop at Centralia.

Earl A. Hedgepath, foreman car repairs of the Southern at Columbia, S. C., has been appointed general foreman car repairs at Richmond, Va.

H. H. Young, superintendent car department of the Illinois Central at Chicago, has, upon his own request, returned to Centralia, Ill., as superintendent of the car shop there.

J. A. Welsch, shop superintendent of the Illinois Central, at Paducah, Ky., has been appointed superintendent car department, with headquarters at Chicago.

Electrical

G. Donovan Henry has been appointed foreman electricians of the Southern at Chattanooga, Tenn.

Master Mechanics and Road Foremen

R. E. Whittaker, assistant master mechanic of the Illinois Central at Markham yard, near Chicago, has been appointed master mechanic with headquarters at Paducah, Ky.

W. C. Fleck, assistant master mechanic of the Pennsylvania, at Fort Wayne, Ind., has been appointed master mechanic at Chicago.

J. Homer Stallings, general foreman of the Southern at Alexandria, Va., has been appointed master mechanic, with headquarters at Charleston, S. C.

F. D. Dunton, master mechanic of the Erie at Secaucus, N. J., has been transferred to Port Jervis, N. Y., with jurisdiction over the Wyoming and Jefferson divisions, and that portion of the New York and Delaware divisions to be assigned. The position of master mechanic at Secaucus has been abolished, and the position of master mechanic at Jersey City, N. J., has been extended to include Secaucus and freight power on the side lines. The position of master mechanic at Avoca, Pa., has been abolished.

Francis L. Hoffman, who has been appointed master mechanic of the New York Central at Buffalo, N. Y., as noted in the August issue, was born on August 6, 1906, at Hornell, N. Y. He attended high school at Jersey Shore, Pa., and is a graduate of Pratt Institute (June 23, 1930). He became a machinist apprentice in the employ of the New York Central at Avis, Pa., on September 1, 1926. Mr. Hoffman took a leave of absence beginning in September, 1928, to attend Pratt Institute, and returned to Avis shop as a special apprentice on July 1, 1930. On June 1, 1933, he became terminal foreman at Newberry Junction, Pa.; in September, 1938, assistant terminal foreman at Avis enginehouse; on April 1, 1943, terminal foreman at Corning

For additional information, use postcard, pages 53-54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90% OF YOUR WELDING
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Here's a sure way to important savings: two P&H Welding Electrodes of such wide usefulness, they can do all your mild steel welding.
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For that other 10% welding — there is a P&H Electrode — AC or DC — for welding all mild, alloy and stainless steels, and cast iron. Also types for building up and hard surfacing.
P&H Model WA-200 Arc Welder for shop work, Welding Service Range to 285 amperes. Other AC and DC models to meet all average requirements. Also skid and wheel mounted for all railroad needs.
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F. L. Hoffman

enginehouse, Corning, N. Y.; on January 15, 1946, assistant master mechanic at Buffalo, and on July 1, 1947, master mechanic at Buffalo.

Shop and Enginehouse

VIRGIL W. TREXLER has been appointed general foreman of the Southern at Monroe, Va.

CARLISLE H. PARTLOW, general foreman enginehouse of the Southern at Alexandria, Va., has been appointed general foreman at Greensboro (Pomona), N. C.

CHARLES O. ARANT has been appointed day enginehouse foreman of the Southern at Meridian, Miss.

BERNARD W. HENDRICKS has been appointed foreman, foundry, of the Southern at Richmond, Va.

C. F. SCHWARTZ, master mechanic of the Erie at Avoca, Pa., has been appointed shop superintendent at Hornell, N. Y.

L. A. DIXON, enginehouse foreman of the Pennsylvania at Williamsport, Pa., has been appointed assistant master mechanic with headquarters at Fort Wayne, Ind.

C. T. EAKER, master mechanic of the Illinois Central at Paducah, Ill., has been appointed shop superintendent, with headquarters at Paducah.

B. P. TAYLOR, chief inspector of the New York, New Haven & Hartford at Van Nest, N. Y., has been appointed general foreman at Van Nest.

A. E. MAYO, general foreman of the New York, New Haven & Hartford at Van Nest, N. Y., has been appointed assistant superintendent of shops at Van Nest.

E. J. KELLEY, assistant superintendent of shops of the New York, New Haven & Hartford at Van Nest, N. Y., has been appointed superintendent of shops at Van Nest.